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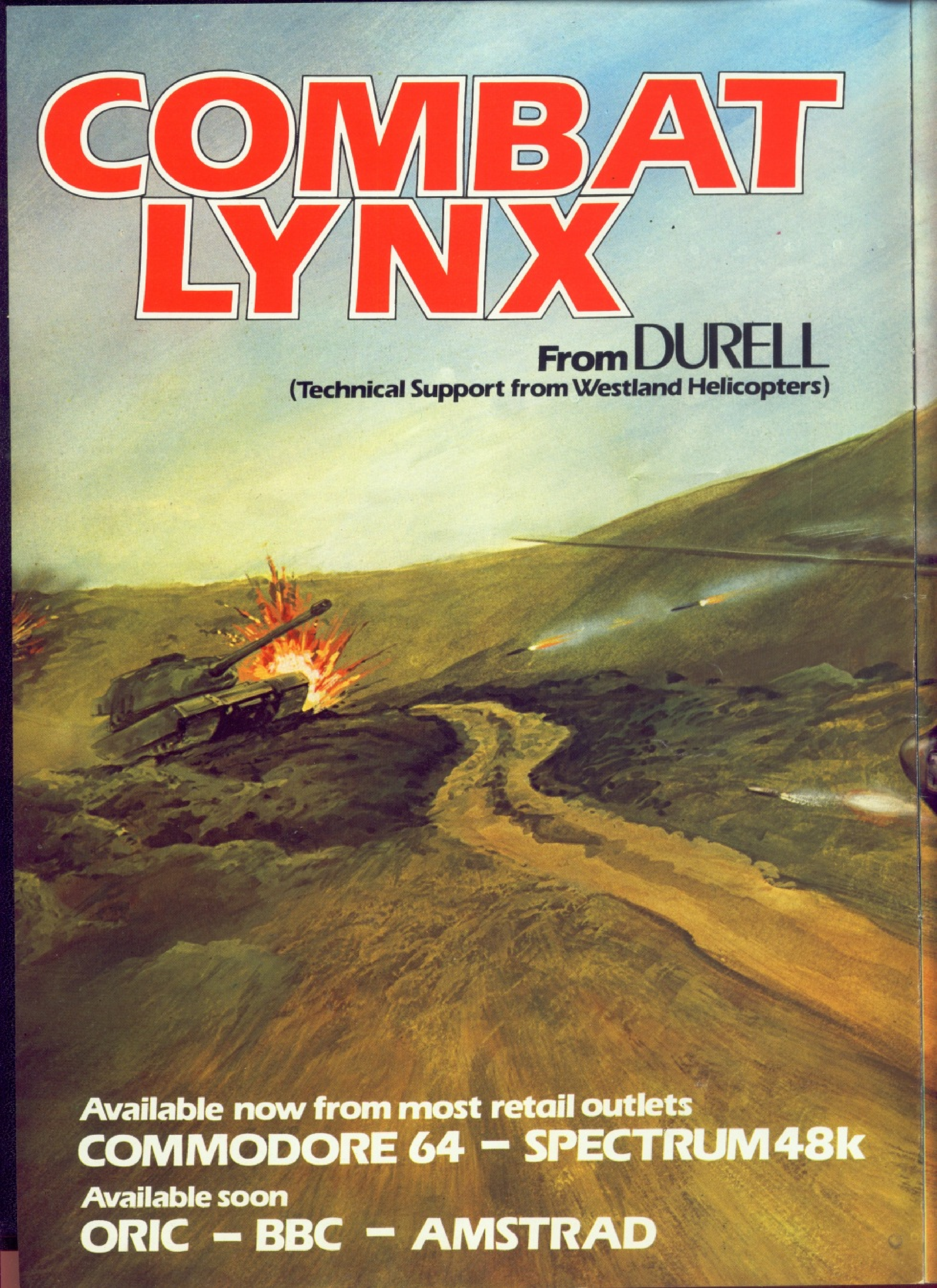

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Computer vision is just one of the exciting areas opening up in the field of Artificial Intelligence.

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A graphics extravaganza including a look at three intriguing graphics packages

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Dear Reader,

Within this issue, you will find the second edition of our Commodore Business Magazine — the only publication of its kind. It contains, among much other exciting, extremely useful and widely varied material, the very first photograph of the until now secret new Commodore computer — the P.C.

However, Commodore Business Magazine will not be of interest just to the 'businessman' but also to anyone who regards a computer as more than simply entertainment. From your initial response to the questionnaire in our last issue a very large number of CCI readers do regard their computer in that 'serious' way. You tell us that, yes, you like games, and, as with other computer users, you are increasingly sophisticated in your choice. But it is clear that you buy CCI for a far greater range of activities, including education, music and, of course, programming — all fully covered in this issue.

For both new Commodore owners and experienced Commodore users, CCI this month as always, in business and throughout the magazine, offers features and reportage that are designed to help you get the very best out of your computer.

From what you tell us, when you buy Commodore Computing International you are sure you are already 'getting in on the best' in magazines. It's very satisfying to know that. We appreciate your interest and thank you for your comments.

Yours sincerely,

Antony H. Jacobson

Antony H. Jacobson.
PUBLISHER

University Software

UNISTAT

STATISTICAL PACKAGE

MULTIVARIATE REGRESSION: Main output consists of estimated coefficients, t-stats, standard errors, R^2, corrected R^2, standard error of regression, F stat, and Durbin-Watson stat. Further output options: multiple correlation matrix, var-covar matrix, ANOVA of regression, residuals, plot of residuals, interpolation. Data options: Log/ln option for each variable, no-constant regression, choice of dependent variable, selection of independent variables, auto-omission of linearly dependent variables.

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DESCRIPTIVE STATISTICS, FREQUENCY DISTRIBUTIONS AND HISTOGRAMS: Analysis of raw data or data with frequency counts. Raw data sorted and grouped. Choice of lower bounds and class intervals. Absolute, cumulative and relative frequencies. Histograms with up to 200 classes. Output displays sum, mean, mean deviation, median, variance, std. dev., 3rd and 4th moments, skewness, kurtosis, range, etc.

All programs are datafile compatible with Matrix Operations program in UNIMAX package. Data matrix capacity examples (columns by rows): **CBM-64;** 2x1250, 5x700, 10x380, **BBC-B;** 2x750, 5x400, 10x200, **48K Spectrum;** 2x1800, 5x900, 10x500. **CBM-64** (disk/cass): **£85, BBC-B** (disk/cass): **£85, 48K Spectrum** (mdvcart/cass): **£60**

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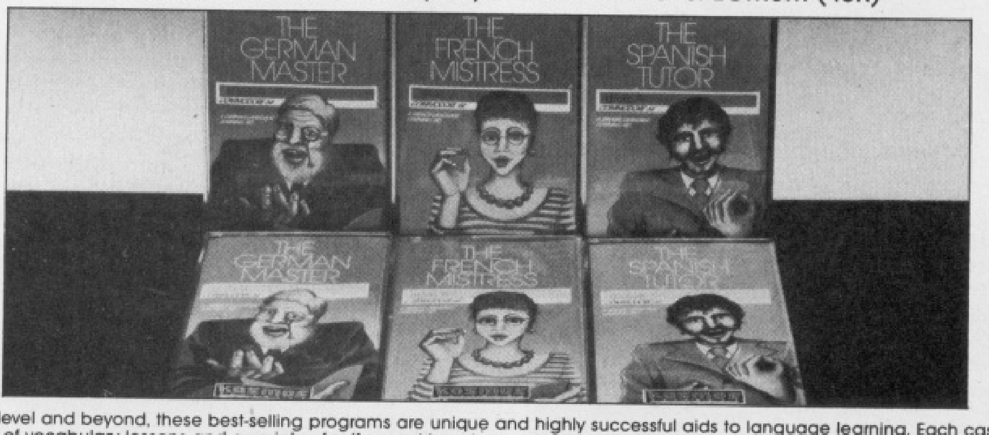

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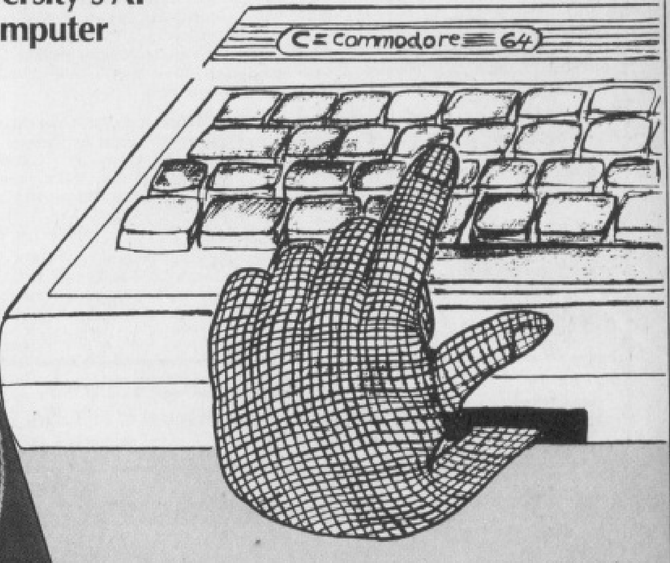
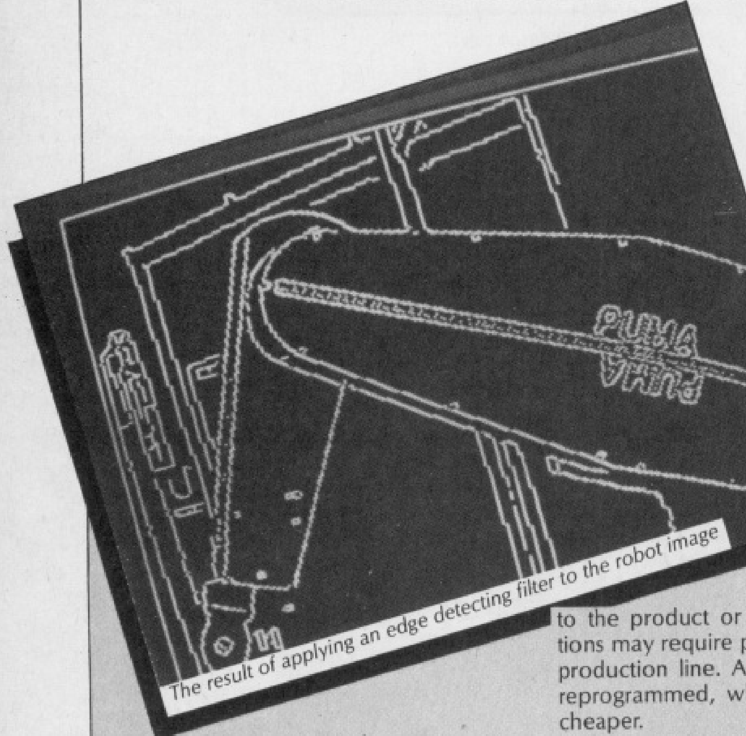
Visions of the future

Artificial Intelligence is increasingly talked about by those involved with computers. This month we begin a series of articles on the varying aspects of AI with a look at just one area, Vision. Richard Tobin of Edinburgh University's AI department explains the current state of computer vision and looks to the future





The result of applying an edge detecting filter to the robot image

The question of how we see things has been considered by philosophers and others for more than two thousand years, but only now are we starting to understand the nature of the problem. Recent progress is in part because for the first time we can conceive of building a machine that can see. Here we look at the reasons why people try to build computer vision systems, and how they go about it.

The best-known applications of computer vision are in industry — flexible automated manufacturing requires systems that can sense their environments. Robots without senses are limited to the simplest repetitive tasks, such as spot welding, and to perform even these the parts must be positioned just where the robot expects them. Vision allows objects to be recognised and their positions to be determined.

Of course, this can sometimes be done by less sophisticated means, such as simple on-off touch sensors. However, such methods lack flexibility — minor changes to the product or component specifications may require physical changes to the production line. A vision system can be reprogrammed, which is typically much cheaper.

Systems of this type may be very different from human vision. For example, they may use lasers or 'structured light'. Some of the techniques used will be discussed below.

Other applications include automatic map-making, image enhancement (eg of satellite pictures), self-guided vehicles, analysis of medical images, and (unfortunately) weapons systems.

The other main area of vision research aims to discover more about how humans see things by building machines that do the same. This research overlaps with psychology and neuro-physiology, and has become very productive due largely to the work of the late David Marr. Marr formulated the problem of vision in terms of information processing. He tried to determine the nature of the computations required to convert the signals from the retina into a description of the objects in a scene. His influence has been such that it is rare to find a paper on the subject that does not refer to his work.

The analogy with human vision has many implications for the design of a successful machine vision system. For example, it is known that the brain performs millions of computations in parallel, at relatively low speeds, whereas conventional computers perform one operation at a time, though at higher speeds. It seems likely that to process information on the scale required for a complete vision system will require the use of parallel machines, and indeed vision is one of the first areas to make use of the parallel processing arrays that are now being produced.

What then is the problem a vision system must solve? Its input is usually a square array of numbers, whose values represent the brightness of each point in the image. Its output should be a description of the scene, and the nature of this description will depend on the purpose of the system.

In an industrial environment it might be of the form "there is a component of type T at position (x,y)". On the other hand, a system aiming to simulate human perception will need to produce a description of the three-dimensional relationships between objects.

In existing industrial vision systems, the methods used are generally fairly primitive. This is because of the very restricted universe within which such a system operates. It may only have to know about one type of object and report its position, or at most distinguish between a small number of well-defined objects.

The input is often a 'binary' image — one in which each point is black or white. In a suitably controlled environment, with objects placed on a plain white background under uniform lighting, this can give the system a silhouette of the object from which various properties can be rapidly computed. These properties are things like area, perimeter, compactness (usually the ratio of area to perimeter-squared), and number of holes. Simple as they may be, these properties are often enough to distinguish one industrial part from another.

For more complex tasks, and especially where three-dimensional information is required, industrial vision usually turns to special-purpose hardware solutions. 'Structured light' is a set of techniques in which the lighting is manipulated to reveal the 3-D structure of an object.

'Striping' is one of these techniques, in which a narrow line (a stripe) of light is directed onto the object. On a flat surface the resulting image is just a straight white line, but where the stripe falls across the edges of a solid object the line bends, and from this the shape of the object can be deduced.

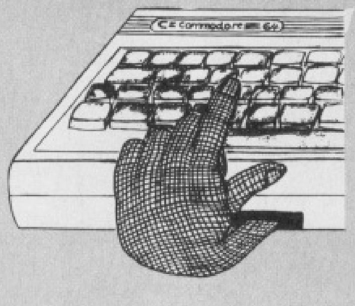
Other systems use direct range-sensing devices. The input here is an array of numbers representing the distance to the object at each point. This data is processed to produce descriptions of the surfaces of the object. Range information can also be found using stereo techniques, as described below.

Human vision faces a much more difficult problem. The viewing conditions in a natural environment vary tremendously. The set of possible objects is extremely large, and objects frequently partially obscure one another. Correspondingly more powerful methods must be used to overcome these difficulties. The problem is far too complex to be solved as a single unit, but it can be broken down into more tractable sub-problems. The break-down that follows is the one accepted by most researchers.

"Existing methods are primitive"

The basic input is the image — an array of numbers representing the brightness at each point. For colour vision, a possible representation would be an image for each of the three primary colours. Just as we have two eyes, so a computer may use two (or more) cameras. Also, the system may receive images in a continuous stream (like a television), so there may well be more than one input image.

An image may contain a million or more points, so the first task is to organize this data into a more manageable form (indeed, one might say that this is the whole purpose of vision). Most of the information in an image lies in those areas where the brightness changes suddenly. These areas can be detected by applying 'filters' to the image. The points detected are then grouped together into edge segments, lines, blobs and so on.



Much early vision research concentrated on the interpretation of perfect line drawings, and it was thought that filtering and grouping could provide the input to these programs. However, it is now realised that in real scenes such simple techniques cannot produce sufficiently reliable data, and that edge-detection is only a first step.

The output from the filtering and grouping processes is called the 'primal sketch'. Its purpose is to make explicit important information about the two dimensional image, primarily the intensity changes there and their geometrical distribution and organization. Its elements are tokens representing these changes and their positions.

The next stage starts to derive three-dimensional information. There is a wide range of techniques available for this. Stereopsis uses two eyes to determine the viewer-object distance. If a scene is observed from two different points, the objects will appear to be in slightly different places in the two images (you can see this by holding a finger in front of your nose and looking at it with each eye). From this difference the distance to the object can be determined by simple geometry. The difficult part is determining the points which correspond in the two images.

The analysis of obscuring boundaries — where one object hides part of another — and surface contours gives important clues to three-dimensional structure. Its importance is illustrated by the fact that we can understand line drawings, where it is the only method available. Computer graphics make extensive use of this method to display three-dimensional surfaces.

In moving scenes, or when the observer is moving, the relative motion of the objects can be extremely useful. A tiger, standing still in the long grass, is almost invisible, but when it moves it can be seen.

"Shading and texture give further clues"

The shading and texture of surfaces give further clues, though these methods work best in conditions of accurately known lighting. The neural methods of the brain are apparently not well suited to the type of computations required, but a computer may well find these methods appropriate.

These processes produce a representation which Marr called the '2½D sketch'. The reason for this name is that although it contains three-dimensional information, objects are still positioned relative to the viewer, and it refers to fragments of surfaces (giving their distances and orientations) rather than to solids.

The next stage — developing full three-dimensional models of the objects — is the least well understood. These models will be used to actually recognise the objects, so they should be described in a modular, hierarchical way. That is to say, they should have rough description with more detail available as required, so that first the range of possible objects can be narrowed down, and then more careful checking carried out. The relationship of sub-parts to the whole should be explicit, so that partially obscured objects can be recognised.

Such a description might be in terms of primitives like solid blobs, sticks and cylinders. For example, a person could be described as a cylinder (the body) with four sticks (arms and legs) and a blob (head) attached. Another approach would be to use more precise models, of the kind used by geometric modelling systems — this would be more appropriate for recognition of industrial parts.

"An analogy with human vision"

What does the future hold for computer vision? Many of the techniques described above are still far from fully understood, There is certainly no system in existence whose performance approaches that of humans. However, I am optimistic that we will make substantial advances over the next few years.

Vision has the advantage (compared with some other areas of artificial intelligence) that its tasks are reasonably well-defined. Researchers in the field have accepted the information-processing pattern with great success.

Vision has benefitted more than other areas from interaction with neuro-physiology. Cells in the visual cortex have been found that appear to perform the smae sort of filtering that computer vision systems do. Whether it woill be possible to detect the higher-level functions is not yet clear.

As industrial robots require more versatile vision systems, more use will be made of the 'AI vision' techniques instead of the 'pattern recognition' techniques used at present. This will require more processor power and memory — the experimental systems built by researchers are invariably far too slow for 'real' applications.

The subject of computer vision is so vast, we have only been able to skim the surface here. For further reading, the best books are 'Vision' by David Marr, published by W.H. Freeman, and 'Seeing' by John Frisby, published by Oxford University Press. Neither is cheap, but your local library certainly ought to have copies.

US gets new goods

The popular Consumer Electronics Show held recently in Las Vegas, Nevada, saw some aggressive action from Commodore — in the US at least.

The company showed two new machines, the Commodore 128 and the Commodore LCD Portable, neither of which are planned for the UK in the near future but will be available in the US by end March or early April.

The 128 machine, which retails at about $300, basically is a C64 with twice the main memory and 48K Rom. Its 8502 processor is compatible with the 6502 system, and memory can be expanded to 512K Ram. The machine can be run three ways: compatible with C64 software; with a second processor, the Z80, built in to make it compatible with CP/M; or in full 128K capacity. One treat for the C128 is a "mouse" type controlling device in development.

The company also has a 5.25 inch 1571 disc drive designed for use with the 128 but sold separately.

The LCD Portable features a liquid crystal display (hence the name LCD) and comes complete with a built-in word processing package, spreadsheet, file manager, software for terminal emulation, notepad and monitor. Memory size is 32K Ram with 96K Rom. Commodore have released no price for the lap-sized LCD.

Bad news...

The launches are a bright spot after a generally bleak Christmas in terms of US sales. Commodore's second fiscal quarter may well be down on that period last year, when the company totalled $431.4 million in sales. In addition to a bland market across the board, Commodore's reliance on the 64 for a second Christmas period probably didn't help.

Apparently the new C16 and Plus/4 machines just didn't carry the weight expected of them.

'Coastel' wins first

THE SUNDAY TIMES
commodore
Young Computer Brain of the Year
-1984-
1984

Fifteen-year-old Peter Chase, "The Brain," shows off the Commodore computer equipment he won when he earned the title in the Commodore/Sunday Times Young Computer Brain of the Year competition.

A 15-year-old from Cambridge (not the university ... yet!) is putting his "computer brain" to work with £2,000 of new Commodore equipment after winning the prize in the annual Young Computer Brain of the Year competition.

Peter Chase submitted the idea for "Coastel," a computer-modem system to aid sailors and coastguards with safer sailing, easier navigation, faster rescues and more detailed information. Already something of a computer whizz kid, Peter attends Comberton Village College in anticipation of his 'O' Levels and already has worked on several types of computers.

He installed one of the computers to help his mother with her academic publishing work and has sold a number of programs. When he leaves school, Peter hopes to study electronics at University. Peter's prize in the competition, sponsored by Commodore and The Sunday Times, was an SX-64 portable computer, colour monitor, colour printer, software and a communications modem.

First prize winners in each age category were Joseph Smith of London in under 13's; Peter Chase in 13-15; and Andrew Hill of Quarndon, Derby in 16-18. Among the runners-up was a six-year-old, Simon Cooper of St. Davids, Dyfed.

New kind of 'white' elephant

A bit of grim humour on this side of the Atlantic last month concerned the well-known circus elephant, Maureen, in Commodore's latest television adverts.

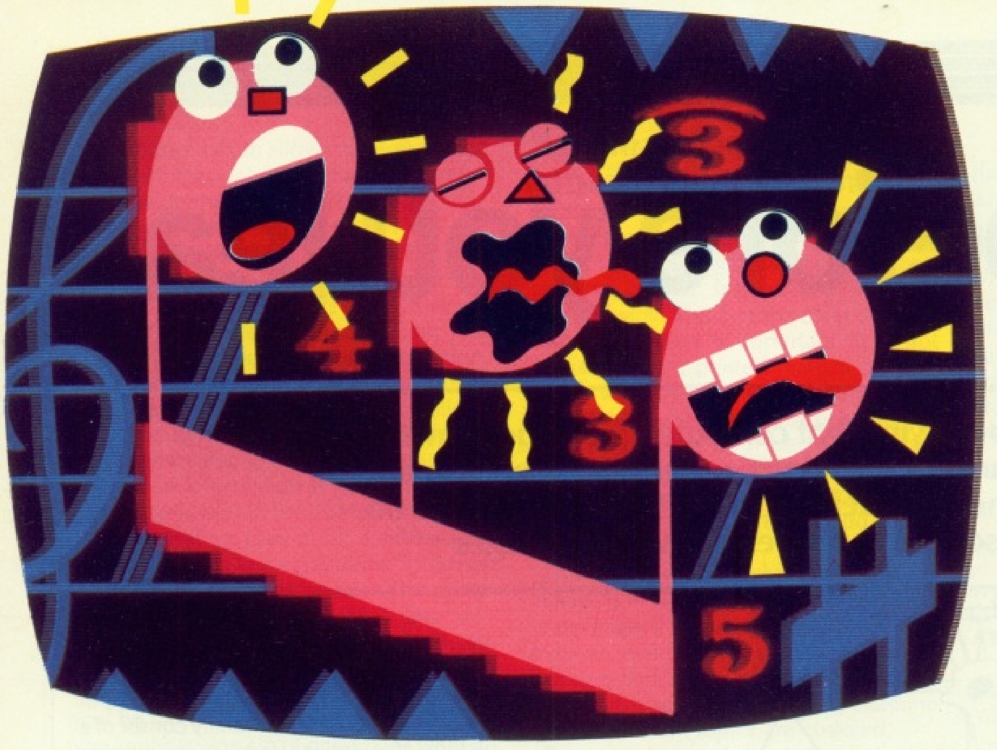
The Royal Society for the Prevention of Cruelty To Animals (RSPCA) lodged official protests with Independent Broadcasting Authority, according to The Guardian. The group objected that using Maureen in the adverts was tasteless and that their stance extended to any use of animals in advertisements. The IBA chairman, Lord Thomson of Monifieth, replied in a letter that the advertisement "which has now come to the end of its natural life, will not be allowed to return to the television screens."

Maureen ordinarily performs in a travelling circus. She was featured in the commercials standing in the corner of a boxing ring as if awaiting a bout with a competitor. Maureen referred to the proverbial "an elephant never forgets" to show the capacity of Commodore's memory.

Currah folds

The collapse of Currah Computer Components Ltd of Hartlepool, Cleveland, late last year drew the attention of Welwyn Electronics which has now taken over sales of Currah's products.

Currah, designer of several products including the Speech 64 synthesiser, went into receivership shortly before Christmas and Welwyn has put together a sales and marketing team to sell the products directly to retail outlets and distributors. Welwyn originally manufactured many of Currah's products, including Speech 64.



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You'll find the new Commodore 64 Music Maker strikes exactly the right note, whether you're an accomplished musician or whether you are an out-and-out beginner.

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And, before you can even say 'Richard Clayderman', the automatic playback fills the room with music.

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You can synthesize musical instruments, even create your own 'synth' electronic sounds.

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(This is the smart way of saying you can play three different notes all at the same time).

At the press of a button, you can summon up pre-programmed rhythms and bass accompaniments to play along to.

These three rhythm combinations can be speeded up or slowed down.

You can even glissando (so long as you don't hurt yourself.)

That is, make a note slide up in pitch.

You can filter sound: reduce the treble, the bass, or both. You can save, on cassette or disk, a voice or tune for future use.

And, for better sound reproduction, you can connect Music Maker to your hi-fi system.

Music Maker has been designed, like all our software, to get the very best out of Commodore hardware.

It's the first in a series of packages which will fully exploit the Commodore 64's outstanding musical capabilities.

Commodore software: it costs no more, even though there's more to it.

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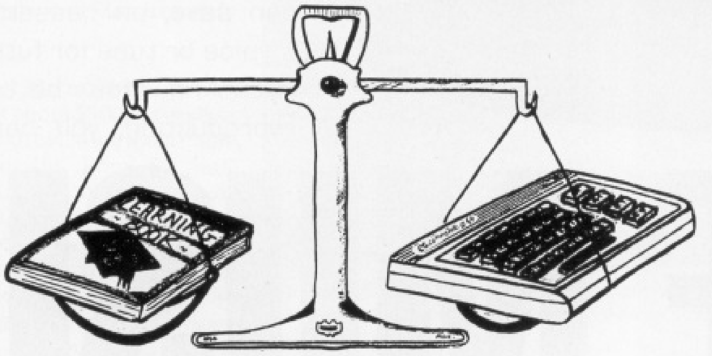
Look before you leap

There's no denying that computers aid education in the home, but are all educational programs superior to books? Ex-teacher Michael Jackman, PhD, offers advice on discovering the best software packages



When buying educational software you need to be aware of two things. First, the types of different software that are available and second, what to look for in specific programs.

The most important types of educational programs are simulation, testing, tutorial and revision packages. Another category to consider is application packages. You need to keep in mind, however, that these are general characteristics of educational software. Good packages will often cut across these boundaries.

Simulation packages are so called because they set up a situation and the user has to work his or her way through it. This may be something simple like getting to school on time in the morning, or more difficult like flying an aeroplane. The format is in many ways like the adventure game, but generally includes a lot of graphics.

In this approach there is not necessarily any deliberate attempt to learn anything. Learning happens while the user attempts to solve various problems. It allows the use to ask "what-if" questions — what happens if I do this, rather than that? It is now acknowledged amongst educationalists that much of what we learn is learnt in this fashion.

Potentially, simulation packages are of enormous value. They have been an important part of industrial training for some time and allow the user to gain valuable experience without expensive or serious consequences. Educational software of this kind is in the minority for the home user at present. Hopefully more of these packages will become available with time.

"Many programs are simply some form of testing"

Many programs you will come across are simply some form of testing. Computers have an advantage in that visual presentation can be made interesting. Tests can be presented in the form of a game and therefore have a fun element. Alternatively the test can be used by an individual. In terms of value for money it is probably better to buy a book, although children may find using a computer more motivating.

Tutorial programs usually involve giving information about something, and then testing on that information. This is known as the drill and practice approach. Any kind of information can be presented from, for example, multiplication tables to A-level physics. These kinds of programs can be used to present new information or used as revision packages.

However, books are likely to be of better value. In the case of revision packages you are unlikely to find a package that covers the whole of a particular syllabus. For under five pounds you can buy a book which does just that. Educational software is generally a lot more expensive.

Another important reason for perhaps ignoring this type of software is that it is based on a rather out-of-date simple psychological model of learning known as Skinnerian conditioning. The basic idea here is that learning is broken down into a number of small pieces of information. The learner has to learn and pass a test on each piece of information. If the learner gets the correct answer then a reward is given and the learner can then go on to the next part of the program. In terms of current computer software, rewards generally consist of a picture of a smiling face, a rocket ship taking off, a short tune, or such like. However, after a very short period of time these "rewards" become very boring and are no longer motivating. This can happen long before the user has finished the whole program.

This particular approach was tried back in the 1950s and 1960s and was found not to work. The information was either present on large mainframe computers, specially designed teaching machines, or in books. There is no reason to expect that simply because the technology has changed this approach will work today. Modern psychological theories see learning as a much more complex process. Accordingly, the designing of educational software requires a more sophisticated approach.

"Well designed tutorial programs have an important part to play"

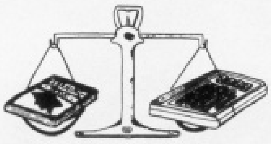
Having criticised current tutorial programs it has to be said that well designed tutorial programs which avoid the drill and practice approach have an important part to play. It would seem to be the case that certain kinds of information require the learner to just sit down and make an effort to learn that information. Tutorial programs are designed to cover just this area. These programs should not only present the relevant information, but should also assess whether the user has learnt that piece of information. The program should also set up situations where the learner can use that information. The ability of the user to ask "what-if" questions is important.

The value of application packages should not be overlooked. These include word processing, databases, spreadsheets, statistical packages, graphics packages and music packages. Graphics and music packages are of fairly obvious educational value for people of all ages while the others require more sophisticated users.

Databases, which allows the user to find out information about a particular topic can be extremely useful. Due to present day memory limitations of micros you are again likely to be better off buying a book. However, databases are being created on large mainframe computers which may be accessed via the telephone line. This will allow the user the find out information quickly and easily about all kinds of things.

You can also buy packages which allow you to set up your own database. This is of educational value since the user has to find the relevant information as well as setting it up appropriately on the computer.

An interesting aspect of databases is what is known as "expert systems". It can be set problems which can be solved by using knowledge from the database. There are now several books on the market which show you how to set up your own expert system on the micro. Expert systems can now be written which diagnose illnesses, why your car won't start or perhaps what is wrong with the TV.



"Expert systems will form the basis of all educational software"

In the not too distant future expert systems will form the basis of all educational software. This will allow the program to investigate what level of attainment the user has reached and then present the relevant program. If the user is having any difficulties then the program will be able to investigate these difficulties and react appropriately. These expert systems will require knowledge gained from psychological research into how learning is achieved — research which is currently being undertaken. However, these expert systems will require large amounts of memory. For this reason, it is likely that you will have to access a mainframe computer via the telephone line.

To summarise so far. The best kind of software available at the moment tends to be simulation packages, although there is very little of it. Tutorial packages are very important since they fill the gap in learning not covered by simulation packages. However, most tutorial packages tend to be of the drill and practice type. Generally speaking, this kind of software is probably best avoided. Presenting tests on computers may be entertaining and it can be useful to the teacher or parent who wants to keep an eye on the progress of the child. For parents, keeping a progress check on one's children is generally more chaply accomplished by buying an appropriate book.

We now need to examine what you should look for when looking at individual software packages.

"Essential to inspect software before buying"

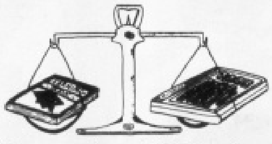
Software can be bought from retail stores as well as through mail order. A problem with buying through mail order is that you cannot inspect the software before buying. This is quite essential.

Documentation is important. It is not necessary that a printed manual be presented with the software. There is no reason why this should not be presented in a separate program from the main program (this would also reduce the price). However, whether presented as a manual or on the screen there should be good documentation.

This should tell you what the aim of the package is — what the user should get from the package. If you are buying software to cover an examination syllabus, you will invariably find that only part of the syllabus is covered. You need to carefully examine whether relevant topics are covered.

The age level of the intended user should be stated. With educational software there should be a fairly specific age range. If the age range is wide, then the software is unlikely to be of much value. Exceptions to this are only likely to be application packages designed for children.

Any specific instructions should be given in the documentation. Good business software now includes "help" menus. These are designed to help the user at various stages in the program. Good educational software should ideally also include "help" menus. The documentation should tell you how to access this information. Also, there may be other aspects of how to use the program which need to be documented.

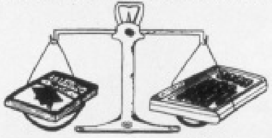


"Better value if designed and written by a team"

It helps to know who designed the package. Given the complexity of designing educational software, it is likely to be of better value if designed and written by a team, rather than an individual. Book publishers are now publishing educational software. They already are used to commissioning educationalists to write books. In the future it is likely that the best software will be published by these companies as a result of commissioning a team of people to design and write the software.

It is important to look at the software actually running on the computer before purchase. Older children should have no difficulty in loading and running any particular package. Younger children, of course, may need help at this stage. Once loaded, the child should be able to work through the program on their own. If he or she needs to turn to an adult to ask what to do next, then the package is likely to badly written.

Good programs should allow the user to move both backwards and forwards within a program. It will often be the case that the user needs to check on something that has been learnt earlier on in the program. Unfortunately, many programs are only designed to go forwards. Ideally, there should be some sort of "help" key which can be pressed to enable the user to go to the main menu, to go to other parts of the program, or simply to get some help on what they are doing at that moment.



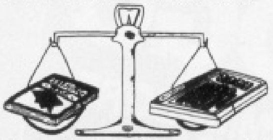
"Programs should be crash-proof"

An essential requirement for good programs is that they should be crash-proof. You should deliberately attempt to crash the program by entering inappropriate data or pressing the run/stop key — or any combination of keys. Having the program stop dead is likely to be very off-putting and to detract from the purpose of the program.

Also, it may not be possible to continue with the program without reloading. If it crashes as a result of typing in inappropriate information then the program has been badly designed.

A useful facility for any program is to be able to print out the results of any test or tests undertaken during the program. This is useful for the parent to ensure that their child is actually using the educational program when hidden away with the micro, rather than playing some game.

Another useful feature which should be present is the option to be able to re-run the program when the end is reached. This requires fairly trivial programming but illustrates that attention has been paid to detail. It also saves time on reloading — which can often be a lengthy process.



"Seek advice from other users"

Read reviews whenever possible. Also seek advice from other users. If you are buying software for use by children then advice from parents on how their children took to a particular program is likely to be invaluable.

Finally, you should not buy software simply because it enables you to use the computer. Educational software should be designed so as to present material in ways that are different from books. If the software could just as well have been presented in book form then it is probably not worth buying. You will undoubtedly be able to find a book which presents the same information, but costs less than the computer program.

SAMS
Learn BASIC Programming in 14 Days on Your Commodore 64
Gil M. Schechter
COMMODORE 64
GRAPHICS
COMPENDIUM
David Durong
SAMS
Commodore 64 Starter Book
SAMS
Mostly BASIC: Applications for Your Commodore 64
Book 1
Howard Berenbon
COMMODORE 64
PROGRAMMER'S REFERENCE GUIDE
commodore COMPUTERS
Pocket Guide
Commodore 64
Boris Allan
Programming Pocket Guides
Jonathan Chapple
I WISH I KNEW...
...about the COMMODORE 64
Get the best
LEARNING LOGO ON THE COMMODORE 64
ANNE McDOUGALL
SAMS
Commodore 64 BASIC Programs
Second Edition
Timothy Orr Knight
Darren LaBatt
SAMS
The Tool Kit Series Commodore 64 Edition
Ted Buchholz and Dave Dusthimer
SAMS COMPUTERFACTS
CC3
COMPUTER :
VIC 20
SAMS COMPUTERFACTS
CC4
COMPUTER :
COMMODORE 64
SERVICE DATA FOR YOUR COMPUTER
SAMS
Commodore 64 Trivia Data Base
Data Base and Trivia Game
James F. Hunter & Gregory L. Gentile
Contains Cassette and Diskette
Pitman Typing
Keyboard Skills

The CCI Readers Club

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Mostly BASIC: Applications for your Commodore 64 *RRP £9.95, CCI Readers Club Price £7.25 (plus p&p)*
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Computer Facts Commodore VIC 20 Commodore 64 *RRP £14.95 each, CCI Readers Club Price £10.95 each (plus p&p)*
Comprehensive packs containing easy to use informative technical data. Each includes specific information on the individual components plus overall trouble shooting hints for keeping your 64 or VIC 20 in top condition.

I wish I knew .... about the Commodore 64 *RRP £5.95, CCI Readers Club Price £4.25 (plus p&p)*
A largely visual approach is used so parents and children can grasp basic ideas about computing and programming. No previous knowledge of computers is assumed. A must for new owners.

Learning LOGO on the Commodore 64 *RRP £5.95, CCI Readers Club Price £4.25 (plus p&p)*
A practical introduction to the exciting new advanced language LOGO — quick and easy to learn but as versatile as BASIC. The book includes many new suggestions for experimenting. Ideal for the more serious user.

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Pocket Guide Commodore 64 *RRP £2.50, CCI Readers Club Price £1.85 (plus p&p)*
For those with no programming experience, this handy reference guide provides vital descriptions of the salient features of the C64, and a lead-in to the BASIC language.

Commodore 64 Programmers Reference Guide *RRP £12.95, CCI Readers Club Price £9.75 (plus p&p)*
All you need to know about the 64; everything from graphics & sound to advanced machine language. A must for all 64 owners.

from your Commodore

Commodore 64 Basic Programs (second edition) *RRP £8.95, Lucky 200 Price £2.95 (plus p&p)*
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An easy to understand course for beginners aged 13+ with explanations of entering and editing programs, printing, loops and arrays, data storage, creating sound and music, colour, animation and designing graphics. A must for all new 64 users.

To: Commodore Computing International, Finsbury Business Centre, 40 Bowling Green Lane, London EC1R 0NE

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64 ways to learn

Michael Jackman casts a critical eye over a selection of educational programs for the 64

MATHS TUTOR

This is a book with an accompanying tape of the programs presented in the book (total price £11.95). The book can be bought separately (price £7.95). The average length of the programs is some 10-15 lines so that you must decide whether the extra £4 is really worth it.

The basic idea of the book is a good one. It is to show how the computer can be used to make laborious calculations and to draw graphs and diagrams — so contributing to the understanding of mathematical concepts. However, the programs written to illustrate graphs are somewhat disappointing as they use low resolution graphics.

The author states that the book is of use to students studying for O and A levels, and first year University. To this end a wide range of subjects are covered.

This book would be of little use for students who find maths difficult as at least half the topics would be beyond them. Also, the material in each chapter is skipped over quite rapidly. For example, the chapter on angles introduces the notion of inverse trigonometric functions in just one page. On this same page students are also meant to cope with a formula such as — ARCSIN X = ATN(X/SQR(-X*X+1)). Students of limited mathematical ability would find such an expression totally incomprehensable.

My overall impression was that the book would be of value to students with some mathematical sophistication. It gives lots of ideas on how to use the computer to illustrate mathematical concepts. Mathematics teachers would also probably find the book to be very useful.

Contact: Century Communications, Portland House, 12-13 Greek Street, London W1V 5LE. Tel: 01-434 4241.

MR T'S SHAPE GAMES

This consists of two "games," although really it is one "game," called Jigsaws, and an applications package, called Shape Maker. Shape Games is part of a series of Good Housekeeping's Early Learning Software.

Jigsaws is a game in which the child is presented with a set of different shapes forming a simple puzzle. Various shapes move down the screen one by one. The child has to press the space bar when the correct shape is overlapping its corresponding shape in the puzzle. There are various difficulty levels which can be set from the menu. This alters the complexity of the jigsaw (of which there are quite a number at any one difficulty level) and how close the shape has to be to the same shape in the puzzle. (I suspect this is done the wrong way round. It would have probably have been better to have the child make the decision before the shapes overlapped).

The second program is an application package. It presents an opportunity to create patterns. Four basic shapes can be drawn — a circle, a square/rectangle, or two kinds of triangles. The size and position of each shape can be altered, and they can be rotated. They can also be coloured. Any combination of these can be created on the screen. The package therefore provides an environment for young children to create many different kinds of patterns. This is a very useful application of computer technology.

Young children do not generally have the manual skills to be able to create these kinds of patterns using paper and pencils. This package allows them to create, explore and learn where they would not otherwise have been able to. The documentation that goes with this package is excellent. It encourages the parent to take an active part in their child's education with the aid of these programs. Many ideas are presented which serve this purpose.

The price is rather high (£9.95) but otherwise I have no hesitation in recommending this package.

Contact: Good Housekeeping, National Magazine House, 72 Broadwick Street, London W1. Tel: 01-439 7144.

DANCE FANTASY

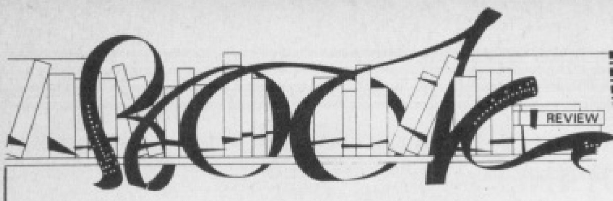
This is an applications program aimed at children of ages 4 to 8 years. It provides an opportunity to create dances using one or two figures.

Dances are created by using a joystick. (Unfortunately, you cannot do without at least one). The starting position is decided by pressing the fire button. One of eight dance steps are chosen by moving the dancer onto one of the eight figures at the bottom of the screen. Pressing the fire button chooses the dance step. The dancer is then moved to a new position where you want that dance step to end. Pressing the fire button again lets you make this decision. When adding new steps the starting position is where the last step ended. So you only have to choose a new dance step and where it is to end. If you do not like a dance step you have chosen, then moving the dancer to an area at the bottom of the screen, and pressing the fire button gets rid of that step.

Performing the whole dance is easily accomplished by again moving the dancer to an area at the bottom of the screen and pressing the fire button. This results in all the dance steps being performed to a simple tune. If you get tired of the tune, you can always play your own music — although this has to be through your own music system. Although these instructions might appear complicated, it would take a young child no time at all to learn them.

This is quite an interesting an useful package. The very young child would produce fairly simple or even random dance designs. However, as the child gets more sophisticated, careful design and planning would be required, and encouraged. Therefore a dance would have to be designed on paper before putting it on the screen. This is of sound educational value in that it teaches the use of careful thought and forward planning. A real bonus in this respect is the fact that any dance can be saved onto tape. Recommended.

Contact: Fisher-Price, distributed by WHS Distributors, St John's House, East Street, Leicester LE1. Tel: 0533 551196.



Computer journalist Peter Arnott-Job evaluates a selection of newly-released computer books.

MOONLIGHTING WITH YOUR PERSONAL COMPUTER by Robert Waxman — £4.95

Moonlighting is earning money on the side by doing work other than your full time job. It refers to anything legal — otherwise such activities are known as crime. Moonlighting undoubtedly has its place in a healthy economy and may sometimes enable the development of a new small business or career in your spare time. But during a period of massive unemployment the idea of moonlighting sometimes takes on a morally dubious character.

Unfortunately the section of Moonlighting with Your Personal Computer on the Ethics and Morality of Moonlighting talks only about the effects that moonlighting might have on your own full time job. It's a shame that Robert Waxman didn't also consider the impact of moonlighting on other people's jobs.

Having said that, there are probably always going to be certain tasks best undertaken by moonlighters and certain people for whom moonlighting is the only way to a new career or business. How useful is this book to those people?

As one who is self-employed in exactly those fields which seem to attract many moonlighters — journalism and computers — I feel confident about commenting. Full-time self-employed, incidentally, which is probably why you detect a hint of resentment at the idea of a crust being snatched from my mouth by someone who's already got a whole loaf! I have to say that if you're seriously considering an alternative career then this book is worth nothing more than a perusal. You may feel that it's worth shelling out £4.95 for such a perusal. I wouldn't.

First of all the author seems to assume that you might say to yourself: 'I want to be a moonlighter.' And then: 'Now what can I moonlight in?' Of course, it is almost always the other way round. You're good at something and you spot an opportunity in that area — or someone spots potential in you.

Until recently computer journalism was an incredibly fertile area for moonlighters. The truth is that computer magazines and book buyers were so desperate to read everything they could about computers that they tolerated some amazing rubbish. In many cases the people producing this rubbish were moonlighters. It was easy money on the side. The trouble was that you didn't always get paid and when you did get paid it wasn't very much.

The same was true elsewhere in the world of computers. New users, especially in business, were often mystified by their wonderful new acquisition and anyone who showed any knowledge of computers would be welcomed as a consultant.

The situation has now changed. Standards have risen and consequently it's much more difficult for moonlighters in computers.

Robert Waxman should have emphasised just how difficult it is to sell your services, whether as consultant computer expert or brilliant journalist. The really important thing is who you know and not necessarily what you know. The book seems to be saying: 'Here is a wonderful opportunity for you and all you need is hard work and a little aptitude.'

In fact, working for yourself (and the sort of moonlighting Robert Waxman is talking about is a form of working for yourself) is exceedingly hard work. Unless you're very lucky it won't take you long to realise that nobody is really interested in you. As far as journalism is concerned there is very little point in sending up unsolicited material. You might get away with it if you've written a particularly good or interesting program but don't bother accompanying it with a beautiful piece of English prose. Keep it short, sweet and simple because they'll probably rewrite it anyway.

In journalism, as in anything else, the most important thing to do is to assess the market. Moonlighting with your Personal Computer does not put nearly enough emphasis on this. Find out what people really want before you start slogging your guts out providing them with something you only *think* they want.

Moonlighting with your Personal Computer is a slick, professional piece of work but it's so incomplete that it's misleading. There's not enough about the dirty side of the business — the sweat and the grind. What about the cheques that bounce? The false cameraderie you have to show towards potential clients and others who owe you money. The hard work, extortionate telephone bills and travelling expenses, the hours and days that go into establishing contacts that lead nowhere? Either Mr Waxman has been extremely lucky or he's limiting his book to the nicer side of the business.

I suppose if you're a moonlighter then that sort of thing won't worry you so much as if you're relying on it to pay your mortgage.

Contact: Blandford Press, Link House, West Street, Poole, Dorset. Tel: 0202 671171.

THE NAKED COMPUTER, by Jack B Rochester & John Gentz — Arlington Books — £9.95

Charles Babbage, grandfather of the modern computer and avowed enemy of street musicians and organ grinders (too noisy), once proposed a steam-driven musical calculator — for the past four years *Computerworld* has hosted the Ridiculous Button Contest, wherein readers submit their favourite cliches and turns of phrase in the hopes of these being chosen to become a CW Button.

A sampling of some pool winners: Kiss my bits... Micros are Thinker toys... Pardon Me, Modem... Floppy now, Hard later... Garbage in, Gospel Out — The French have introduced a 'smart' credit card. It comes with a micro computer embedded in it. It will remember transactions and keep customer account data, like having a branch bank in your pocket.

The Naked Computer contains these and many, many more amusing, informative mind boggling insights into the already extraordinary world of computers. It is the perfect antidote to all the serious computer handbooks. It tells you all you could possibly want to know in a lighthearted entertaining style.

It also includes some of the funniest lists you could imagine — the biggest failures in computer companies; the largest computer crimes and many more. It will keep you flipping through the pages for even more outrageous facts. Did you know that Panasonic has a factory making vacuum cleaners staffed entirely by computerised robots, which operates 24 hours a day, 7 days a week in total darkness? Or that the fastest computer printer can print a 224-page book in 30 seconds and its primary use is printing junk mail? This and much more is revealed in the 'Soap' of the Monte Python world of computers. No-one, with even the slightest interest in computers, can afford to be without it. It would make an ideal present but be sure you borrow or steal it back.

Sylvester Broadwell

THE COMMODORE C16/PLUS4 COMPANION by Brian Lloyd — £5.95

It seems there are many more similarities between the C16 and Plus/4 than there are between the VIC 20 and Commodore 64. The last two weren't launched together, of course, while the most recent machines are much more closely related. There is a huge gap in memory capacity, of course — the power up message for the C16 shows 12277 bytes free while the power up message for the Plus/4 shows 60671 bytes free.

But it seems that it's much easier to write a book that covers both the C16 and the Plus/4 than it would be to write a book that covered both the VIC and the 64. The Commodore C16/Plus4 Companion makes a pretty good job of covering both machines. This is largely because it sticks mainly to an explanation of BASIC V3.5 — incidentally, a great improvement on the BASIC used for the earlier machines. The same version of BASIC is used on both the new machines, of course.

It's well written and clearly explained in language that most people should be able to understand. It's friendly without being too matey. I also like the clear and uncluttered presentation.

The book is not ambitious, takes a simple approach to its subject and is limited in scope but it does what it claims. It's a good beginner's book and would be a welcome addition to the shelves of anyone who's just bought a C16 or Plus/4 as their first computer.

Contact: Sunshine Books, 12-13 Little Newport Street, London WC2H 7PP. Tel: 01-437 4343.

GATEWAY TO COMPUTING WITH THE COMMODORE 16: BOOK ONE AND BOOK TWO by Ian Stewart — £4.95

Most of the new books for the new Commodore machines are, understandably, beginners' books. And, on the whole, they're the same as all the other beginners' books. The problem for writers and publishers is how to explain a complicated subject fully without appearing childish and patronising. In some cases it's difficult to judge whether the author has overstepped the mark in his or her attempt to make the subject understandable or whether the book is really intended for children. The Gateway books are such a case.

There's a whole series of them for different computers. They all follow the same format and even use exactly the same words where differences between computers don't make this impossible. Unfortunately they are a prime example of a book where the attempt at user friendliness actually gets in the way. It is a matter of personal taste but I found the books ridiculously silly. In a chapter headed 'She was only a farmer's data', for instance, the following occurs: 'Millicent MacHaddock the Misguided Milkmaid, famous as the inventor of the Millie-Litre, has been asked by her father Hamish MacHaddock to computerise the farm records. Millie starts by listing all the cows in her flock. (What? Herd of cows? All together now..." Of course I've heard of cows!) Each cow has a serial number marked on its ear. (Each cereal has a cow number marked on its ear, too, but that's not relevant here.) And soon. Apologies for the long extract but it enables you to make up your own mind about the style.

As far as I'm concerned the fake matiness and the silly jokes only get in the way. It reminds me of that stereotype second-hand car salesman: a bit of a spiv, forever nudge-nudging, wink-winking, sticking his face right into yours and telling silly rude jokes. Know what I mean, John?

Is it a book for kids or is it a book for adults? I couldn't tell from the text. The language and humour are exceedingly childish in parts and yet the vocabulary and, at times, the assumed level of technical sophistication seem to be aimed above the heads of kids.

If everything else had worked then the books would have been very good. Perhaps for you the humour and matiness will work. If that's so then the Gateway books would be worth buying.

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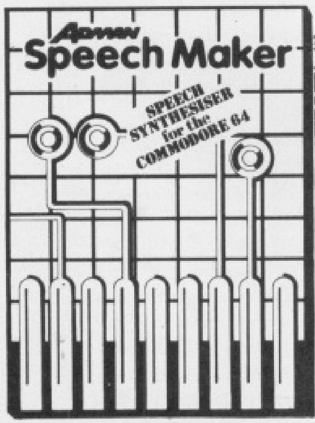
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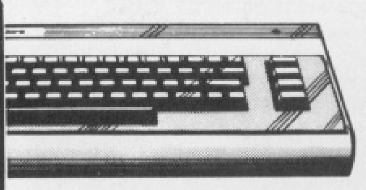

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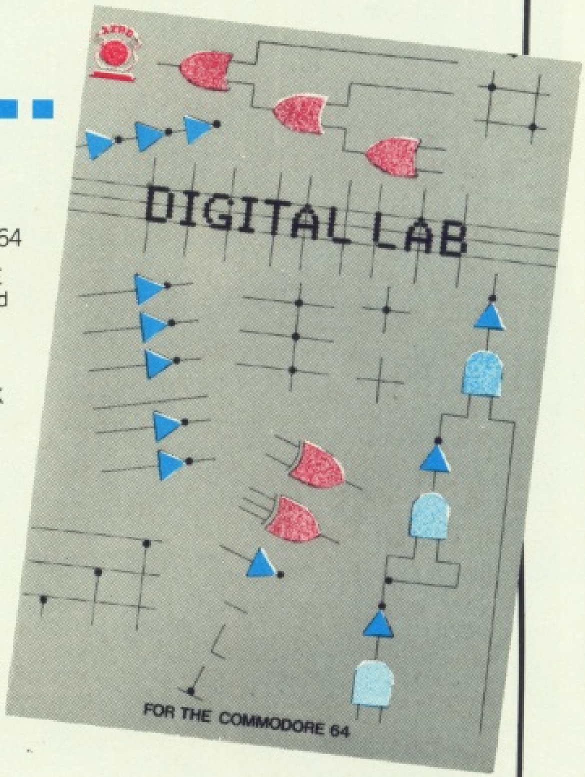

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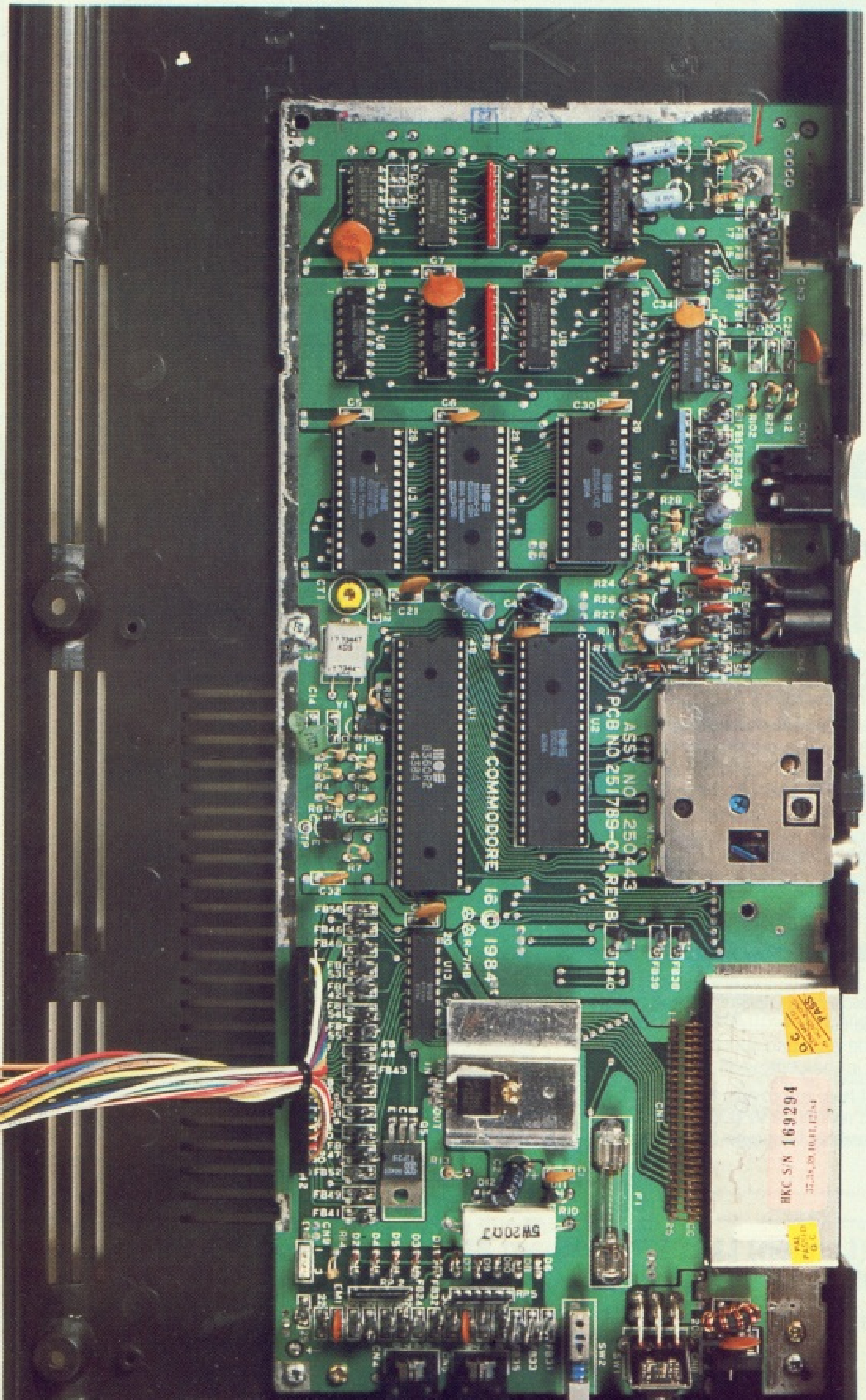
Under cover –

Taking the lid off one of Commodore's newest babies, the C16, and discovering just what makes it tick



① 8501 microprocessor

Similar in operation to the 6502, it takes the full documented 6502 instruction set. It handles both the serial and cassette port. It has a 7 bit bi-directional i/o port located on the chip. Output registration is located at 001 and data detection is located at 000.

② 8360 TED chip (Text Display)

This chip handles video and sound (among numerous other things). The C16 has no sprite capabilities, but it does offer horizontal and vertical scrolling and bit map graphics.

The 8360 also controls the internal i/o handling, internal address bus, clock, keyboard, joystick port, and memory arrangement.

③ Kernal ROM

Controls operating system.

④ Reset switch

The C16 and Plus/4 are the first Commodore computers to feature the reset switch, a device which enables you to restart the computer without switching it off.

Another useful feature of the reset switch: if the machine is stuck in a loop you can press the reset switch and hold down the Commodore key which will enables the computer to power up into the monitor.

⑤ RAM chips

The C16 has 16K of RAM. There is no colour RAM because the C16 has 12 colours and therefore requires a full Byte per colour location rather than ½ as in the 64.

⑥ 6529 chip

This chip is a bi-directional buffer which looks after keyboard controls.

Inside the C16

⑦ Address bus
(only visible on rear)

The address bus is 16 bits wide and bi-directional, carrying memory from microprocessor to memory.

⑧ Data bus (only visible on rear)

The data bus is 8 bits wide and carries data back and forth between CPU and memory.

This controls standard peripherals such as disk drive and printer.

⑩ Cartridge/ expansion port

Provides the option for any expansion which may be produced and games cartridges.

⑪ Cassette port

On this model, the cassette port is non-standard, ie it isn't compatible with standard cassette recorders. However, a cassette unit is supplied with the C16.

⑫ Control ports 1 & 2

Again non-standard requiring special peripherals, for example joysticks.

⑬ Ferrite beads

Large quantities of these appear in the C16, particularly around the cassette, user and keyboard port. They are filter devices for removing spikes off of signals and for making the computer run quieter. They result in less interference and more reliability.

⑭ 7805 voltage regulator with heat sink

Rather self explanatory, this controls the voltage ensuring a steady 5V from the power supply.

⑮ 74257 and 74 125 tri-state buffers

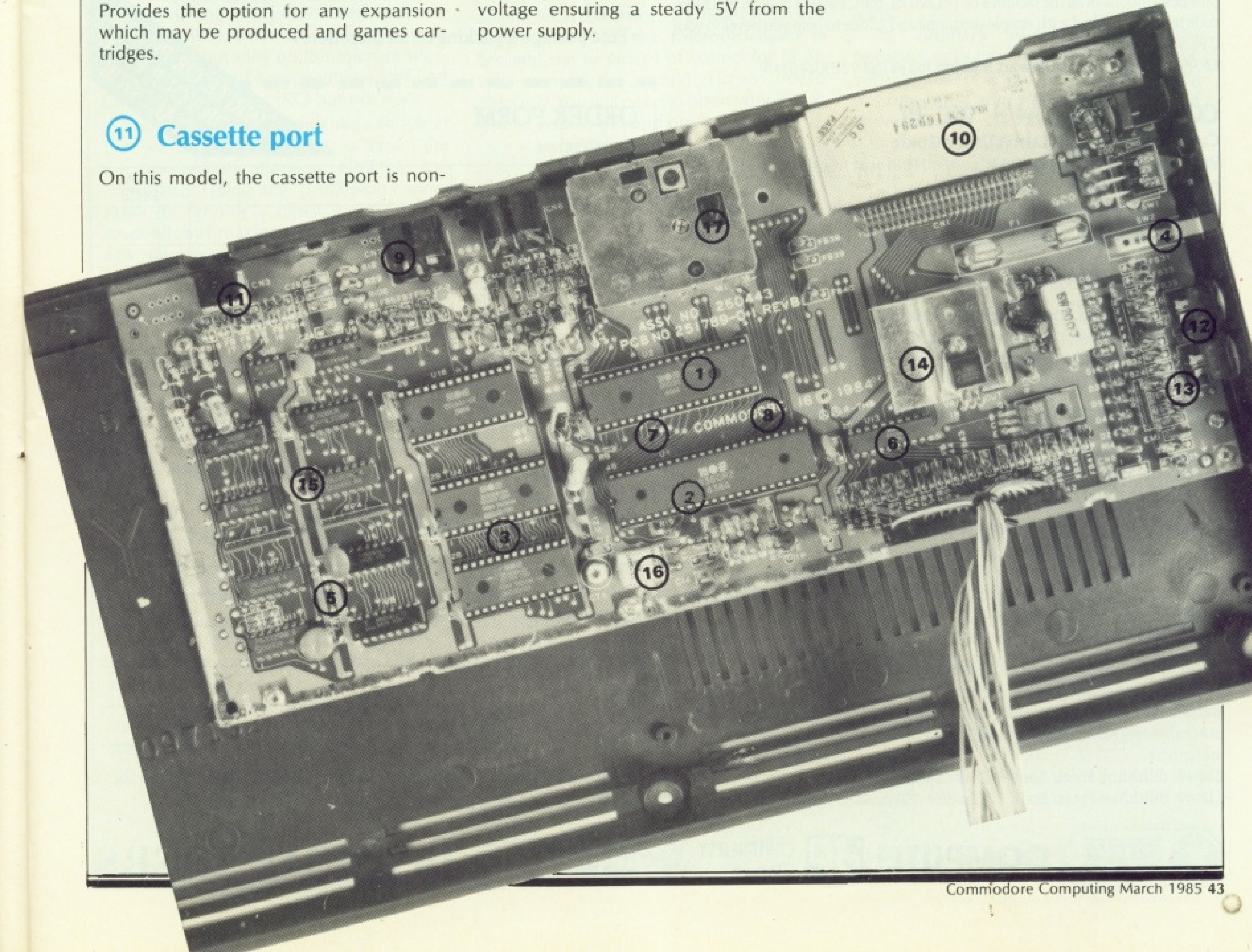
These provide the logic for interfacing RAM chips with address and databuses. They also control passage of information out of RAM chips.

⑯ Clock generator

Requires 17MHz for the UK PAL operating system. It starts at 17MHz and works down to 1MHz to drive system.

⑰ Modulator

Converts internal signals into TV signals and controls colour from TED, luminance and sound.



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Utilizing NMI — a mini-project

Ever wished you could escape from a stuck Machine Code program. David Hornsby tells you how to do this and more by utilizing Non Maskable Interrupts on your PET

There are two "interrupts" on the 6500 series of microprocessors, the little used NMI and the much used ordinary interrupt (IRQ). Both are associated with individual input pins on the microprocessor chip (pin 6 and 4 respectively). PET and CBM computers use IRQ but not NMI.

Both interrupts are rather-like a shoulder that we as users can "tap" to attract the microprocessors attention. NMI has top importance since the processor cannot mask (or ignore) a signal input on it. It responds by breaking off from the program it is running and performing an interrupt routine.

As an example of this, I have seen a PET controlling a model train set under interrupt. The machine was running "INVADERS" at the same time with no apparent decrease in speed. This was possible because the processing time to control the train was very short. Each interrupt came from a sensor in the track and all the PET had to do was to change the setting of one of the points via its user port before continuing with INVADERS.

Other suggested uses have included escaping from stuck machine code programs, performing some emergency routine perhaps at the onset of a power failure (obviously a rather specialised safety feature), dumping the screen contents to a printer, adding new key functions and new buttons and so on.

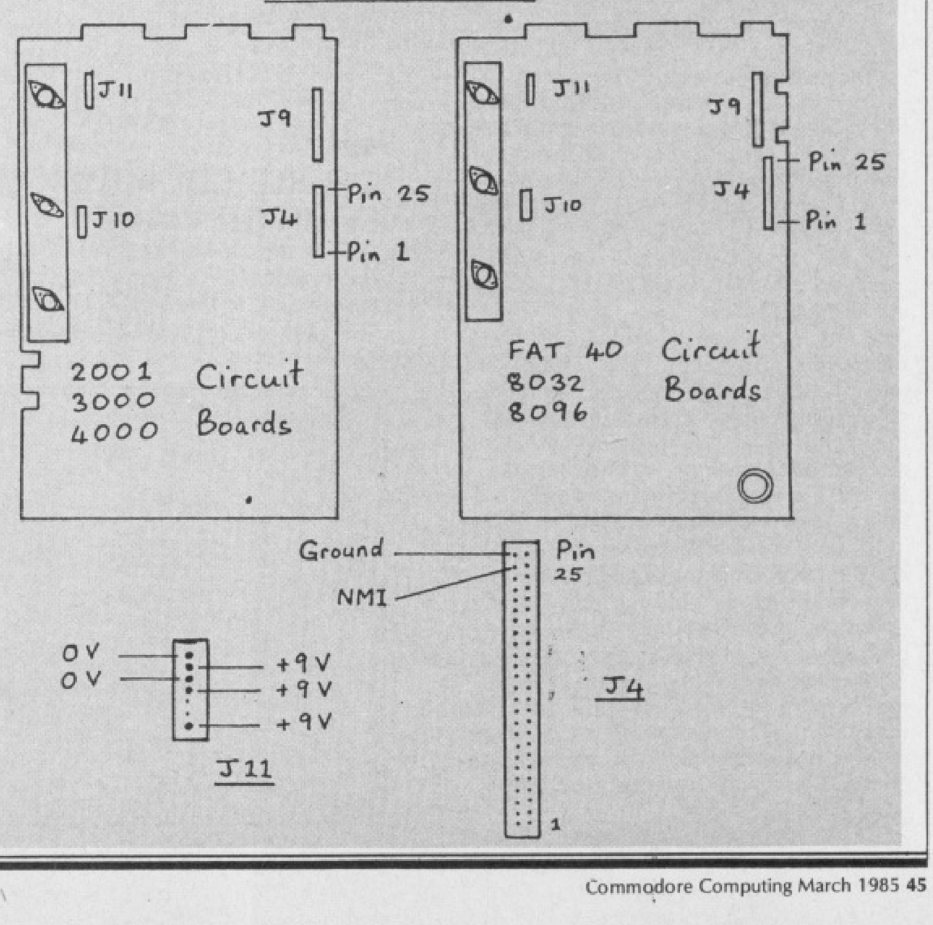
We will look at the structure for all of these applications presently, but let's start with the hardware needed for NMI.

The Hardware Circuit

The "tap" on the microssor's shoulder is an electrical pulse from a simple electronic switch. Pin 6 of the microprocessor is brought out to pin 24 of connector J4 on the computer's printed circuit board (figure 1). You will need to open your PET to gain access to this and buy a suitable connector and a few other simple electronic parts.

An ordinary switch is unsuitable because, as its contacts close they bounce very rapidly for a few milli-seconds giving not one but a series of pulses. We might never notice this (for instance when

FIGURE 1.



switching on a light bulb) because the bouncing is too rapid and only lasts for a fraction of a second. However, a microprocessor operates fast enough to react to each individual switch bounce.

Some simple de-bouncing circuits for the PET NMI pin have been suggested in other magazines and books, but I have found them to be unreliable. The monostable circuit in figure 2 works reliably.

The circuit may be built on a small Vero board and needs a 5 volt power supply. I recommend that you use the three terminal voltage regulator circuit that is shown in figure 3. It runs from the 9 volt general supply rail and means that you use only existing circuit connection pins. If you don't mind soldering a connection to the circuit board, then the regulator circuit can be omitted by making a connection to an existing 5 volt line which may be readily found on the circuit board with the aid of a voltmeter.

How NMI works

When a pulse is applied to the NMI pin of a 6500 series processor, the negative going edge of the pulse forces the processor to perform an interrupt. This means that several things happen automatically.

1) The processor completes whatever instruction it is part way through.
2) The address of the next instruction is saved together with the flag register (into stack memory). This is so the processor can return to where it was when the interrupt is complete.
3) The processor goes to the start of the interrupt routine (which must already be in memory) by inspecting the contents of two ROM location, $FFFA and $FFFB and reading the address there (this is part of the fixed behaviour of all 6502 microprocessors, not just the PET).

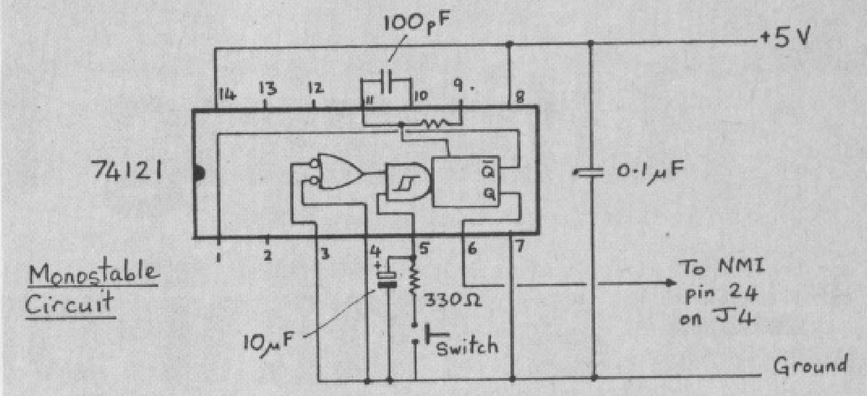
Commodore arranged to vector (redirect) NMI to go on via memory locations $94 and $95 in the PET, which being in RAM are easily changed and allow us to direct NMI to a machine code program of our own anywhere in memory. The locations are set at switch on to point to a routine which simply prints READY leaving you in BASIC mode.

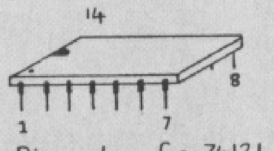
In fact, when you have built the NMI switch you can test it by seeing if it causes the computer to print READY on the screen. This should happen no matter what the computer is doing (running BASIC, machine code or simply waiting idle) since the 6502 microprocessor always gives an NMI request priority over every other task.

To make NMI work for us we will set $94 and $95 to point to a machine code routines of our own. Unfortunately, BASIC cannot be used and in any case would probably prove hopelessly slow.

We must also ensure that the interrupt routine we write will allow us to return to the main program that was running as if nothing had happened. This means that there will have to be four parts to the routine:—

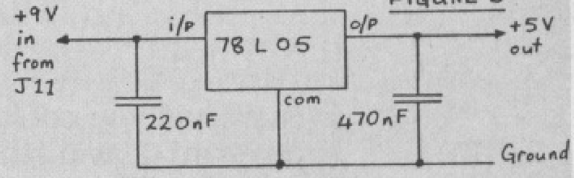
FIGURE 2.



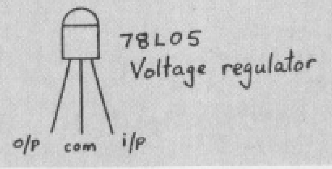


Pin numbers for 74121

FIGURE 3



5Volt Power supply.



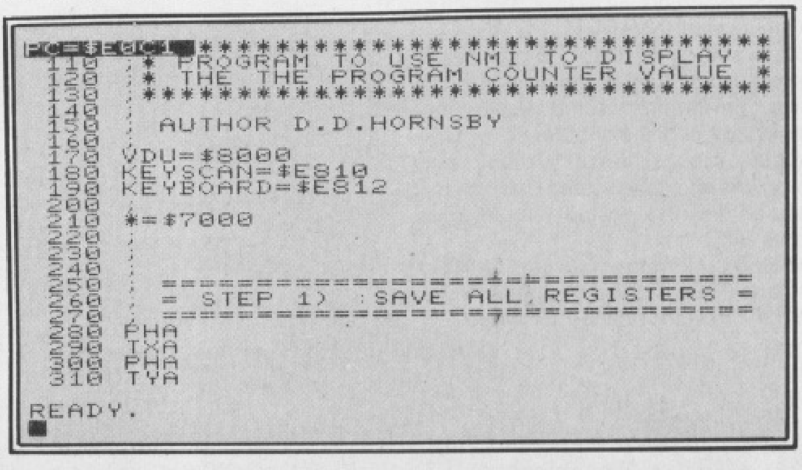
Structure of all Interrupt Routines

1) Save the processors registers
2) The routine itself
3) Restore the saved registers (so that the main program will continue exactly the same as if interrupt has not happened)
4) Return to the interrupted main program.

Steps 1, 3 and 4 will be the same code for all interrupt routines. Only step 2 will vary according to our application.

A SCREEN DUMP SHOWING THE PROGRAM COUNTER VALUE

This is the appearance of the VDU screen when the NMI switch is pressed. The top left of the screen shows that in this case the program counter was at address $E0C1. This is part of the "input from keyboard" routine. Pressing a SHIFT key restores the VDU to normal and the computer carries on as if nothing had happened.



```
PC=$E0C1 ******************************
 110  ;* PROGRAM TO USE NMI TO DISPLAY *
 120  ;* THE THE PROGRAM COUNTER VALUE *
 130  ;********************************
 140  ;
 150  ;  AUTHOR D.D.HORNSBY
 160  ;
 170  VDU=$8000
 180  KEYSCAN=$E810
 190  KEYBOARD=$E812
 200  ;
 210  *=$7000
 220  ;
 230  ;
 240  ;
 250  ;  ==============================
 260  ;  =  STEP 1)  :SAVE ALL REGISTERS =
 270  ;  ==============================
 280  PHA
 290  TXA
 300  PHA
 310  TYA

READY.
■
```

NMI program example

The program is a utility to display the contents of the program counter at the moment of the NMI request. This address is the one saved on the stack as part of the response to interrupt.

You can then see where the processor is working in ROM or RAM when it is performing a particular routine which might be BASIC, machine code, PASCAL, FORTH or whatever. Simply press the NMI button at the time of interest and the screen will freeze, displaying the answer at the top left hand corner of the VDU (as shown in the screen dump of figure 3). Press a shift key and the program will resume as normal. Note in the assembly listing how steps 1, 2, 3 and 4 are marked for clarity of understanding.

There is a monitor dump for those who do not wish to use an assembler. The code is suitable for BASIC 2/3/4 and the two bytes marked also allow the program to work with an 80 column PET/CBM.

Before going further we ought to note two important facts. First, I have placed the NMI code at address $7000, chiefly because I have used the MIKRO assembler chip which automatically uses this area. You may need to reserve space at the end of RAM using say:

POKE 53,112: POKE 52,0:CLR

or choose some other place to put your code such as a cassette buffer.

Second, you will have to point the RAM NMI vectors at $94 and $95 to the start of your NMI program. This may be done in BASIC, machine code or directly from the monitor. The program would be (for NMI at $7000):

BASIC	ASSEMBLER
POKE 149,112	LDA #$70 STA $95
POKE 148,0	LDA #$00 STA $94

It is left to you to devise other uses but let me seed a few ideas into your mind.

a) The example program might be modified to provide a set of function keys which could be detected after NMI via the user port.

b) A screen dump to printer is straight forward to arrange. All you need is a machine code printer dump routine (examples have already appeared in this magazine).

c) Buy a 4K battery back-up CMOS RAM (advertised in this magazine). Copy the $F000 ROM contents into it and then substitute that ROM with the CMOS one. You may then directly change locations $FFFA and $FFFB, the NMI vectors, to go straight to your NMI routine. Since there are about 565 unused bytes of memory in the F ROM you might think of putting your interrupt routine there too.

```
100  033A                ; **********************************
110  033A                ; * PROGRAM TO USE NMI TO DISPLAY *
120  033A                ; * THE THE PROGRAM COUNTER VALUE *
130  033A                ; **********************************
140  033A                ;
150  033A                ; AUTHOR D.D.HORNSBY
160  033A                ;
170  8000                VDU=$8000
180  E810                KEYSCAN=$E810
190  E812                KEYBOARD=$E812
200  033A                ;
210  033A                *=$7000
220  7000                ;
230  7000                ;
240  7000                ;
250  7000                ; ================================
260  7000                ; = STEP 1) :SAVE ALL REGISTERS =
270  7000                ; ================================
280  7000  48                        PHA
290  7001  8A                        TXA
300  7002  48                        PHA
310  7003  98                        TYA
320  7004  48                        PHA
330  7005                ;
340  7005                ; ===================================
350  7005                ; = STEP 2) :THE INTERRUPT ROUTINE =
360  7005                ; ===================================
370  7005                ;
380  7005                ; -------------------------------------------
390  7005                ; - SAVE 9 BYTES FROM THE TOP LEFT OF
400  7005                ; - THE VDU SCREEN ONTO THE STACK AND WRITE
410  7005                ; - THE MESSAGE BYTES IN THEIR PLACE
420  7005                ; -------------------------------------------
430  7005  A209                      LDX  #9
440  7007  BDFF7F  L1                LDA  VDU-1,X
450  700A  48                        PHA
460  700B  BD6970                    LDA  MESSAGE-1,X
470  700E  9DFF7F                    STA  VDU-1,X
480  7011  CA                        DEX
490  7012  D0F3                      BNE  L1
500  7014                ;
510  7014                ; ------------------------------------
520  7014                ; - EXTRACT THE VALUE OF THE PROGRAM
530  7014                ; - COUNTER FROM THE STACK AND FIT IT
540  7014                ; - INTO THE MESSAGE ALREADY ON THE VDU
550  7014                ; ------------------------------------
560  7014  BA             TSX
570  7015  BD0F01         LDA  $010F,X       GET PROGRAM COUNTER HI
580  7018  205070         JSR  CONVERT TO SCREEN CODE
590  701B  8C0480         STY  VDU+4 FIT IT INTO VDU MESSAGE
600  701E  8D0580         STA  VDU+5
610  7021  BD0E01         LDA  $010E,X       GET PROGRAM COUNTER LO
620  7024  205070         JSR  CONVERT TO SCREEN CODE
630  7027  8C0680         STY  VDU+6 FIT IT INTO VDU MESSAGE
640  702A  8D0780         STA  VDU+7
650  702D                ;
660  702D                ;
670  702D                ;
680  702D                ;
690  702D                ; -------------------------------------
700  702D                ; - TEST FOR A SHIFT KEY BEING PRESSED
710  702D                ; - AND LOOP ROUND UNTIL THIS HAPPENS
720  702D                ; -------------------------------------
730  702D  A908           LDA  #8            ROW 8 OF KEYBOARD MATRIX
740  702F  8D10E8         STA  KEYSCAN
750  7032  AD12E8  NO     LDA  KEYBOARD
760  7035  C9DF           CMP  #%11011111 IS IT THE RIGHT SHIFT KEY
770  7037  F006           BEQ  YES
780  7039  C9FE           CMP  #%11111110 IS IT THE LEFT SHIFT KEY
790  703B  F002           BEQ  YES
800  703D  D0F3           BNE  NO            LOOP ROUND AGAIN
810  703F                ;
820  703F                ; --------------------------------------
830  703F                ; - REWRITE 9 BYTES PREVIOUSLY STORED
840  703F                ; - ON STACK BACK TO VDU TO RESTORE
850  703F                ; - IT TO ITS ORIGINAL STATE
860  703F                ; --------------------------------------
```

```
 870  703F  A200      YES           LDX  #0
 880  7041  68        L2            PLA
 890  7042  9D0080                  STA  VDU,X
 900  7045  E8                      INX
 910  7046  E009                    CPX  #9
 920  7048  D0F7                    BNE  L2
 930  704A            ;
 940  704A            ; ===================================
 950  704A            ; = STEP 3) :RESTORE ALL REGISTERS =
 960  704A            ; ===================================
 970  704A  68                      PLA
 980  704B  A8                      TAY
 990  704C  68                      PLA
1000  704D  AA                      TAX
1010  704E  68                      PLA
1020  704F            ; ===================================
1030  704F            ; = STEP 4) :RETURN FROM INTERRUPT =
1040  704F            ; ===================================
1050  704F  40                      RTI
1060  7050            ;
1070  7050            ;
1080  7050            ;
1090  7050            ; -----------------------------------
1100  7050            ; - SUBROUTINE TO CONVERT BYTE INTO
1110  7050            ; - SCREEN CODE FORM
1120  7050            ; - BYTE IS PASSED IN A-REGISTER
1130  7050            ; - AND RETURNED IN :-
1140  7050            ; - A (LO NIBBLE),
1150  7050            ; - Y (HI NIBBLE).
1160  7050            ; - THE SUBROUTINE VDUCODE IS USED
1170  7050            ; -----------------------------------
1180  7050  48        CONVERT PHA                 SAVE BYTE ON STACK
1190  7051  4A                     LSR  A            EXTRACT HI NIBBLE
1200  7052  4A                     LSR  A
1210  7053  4A                     LSR  A
1220  7054  4A                     LSR  A
1230  7055  206070                 JSR  VDUCODE      CONVERT NIBBLE
1240  7058  A8                     TAY               HI NYBBLE PLACED IN Y
1250  7059  68                     PLA
1260  705A  290F                   AND  #$0F         EXTRACT LO NIBBLE
1270  705C  206070                 JSR  VDUCODE      CONVERT LO NIBBLE
1280  705F  60                     RTS               LO NYBBLE PLACED IN A
1290  7060            ; ----------------------------------------
1300  7060            ; - ROUTINE TO CONVERT A HEX NIBBLE
1310  7060            ; - IN A-REGISTER INTO PET VDU
1320  7060            ; - CODE AND RETURN RESULT IN A-REGISTER
1330  7060            ; ----------------------------------------
1340  7060  18        VDUCODE       CLC
1350  7061  69F6                    ADC  #$F6         IS IT A DIGIT 0-9
1360  7063  9002                    BCC  V1
1370  7065  69C6                    ADC  #$C6         CONVERT TO SCREEN LETTER
1380  7067  69BA      V1            ADC  #$BA         CONVERT TO SCREEN NUMBER
1390  7069  60                      RTS
1400  706A            ; -----------------------------------
1410  706A            ; - MESSAGE DATA FOR PRINTING ON VDU -
1420  706A            ; -----------------------------------
1430  706A            ; PC=$....<SPACE>
1440  706A  9083BD    MESSAGE       BYT  $90,$83,$BD,$A4,$B1,$B2
1450  7070  B3B420                  BYT  $B3,$B4,$20
```

80 Column machines

```
.
.:  7000 48 8A 48 98 48 A2 09 BD
.:  7008 FF 7F 48 BD 69 70 9D FF
.:  7010 7F CA D0 F3 BA BD 0F 01
.:  7018 20 50 70 8C 04 80 8D 05
.:  7020 80 BD 0E 01 20 50 70 8C
.:  7028 06 80 8D 07 80 A9 06 8D
.:  7030 10 E8 AD 12 E8 C9 BF F0
.:  7038 06 C9 FE F0 02 D0 F3 A2
.:  7040 00 68 9D 00 80 E8 E0 09
.:  7048 D0 F7 68 A8 68 AA 68 40
.:  7050 48 4A 4A 4A 4A 20 60 70
.:  7058 A8 68 29 0F 20 60 70 60
.:  7060 18 69 F6 90 02 69 C6 69
.:  7068 BA 60 90 83 BD A4 B1 B2
.:  7070 B3 B4 20 AA AA AA AA AA
.
```

Final thoughts

So far we have only considered programs with interrupts being produced by a user push button switch. A possible variation for further experimentation is to arrange for the NMI interrupt to come from some other source; perhaps an alarm circuit to protect your house from intruders or a frost-stat to warn you of low temperatures. This is how the PET controlling the train set was configured.

Your imagination may suggest other possibilities, but even if you don't really need these things, do have a "play" with NMI since even with only a simple push button, your power over the computer is usefully improved and your understanding extended as you experiment with the various possibilities.

Interrupt is supposed to be the most complicated part of any microprocessor system but I believe the ideas presented here will give you an easy to understand way into this topic.

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3	Select 1	UP	Computer Records	12.95
4	International Football	UP	Commodore	14.95
5	Chiller	NEW	Mastertronics	1.99
6	Raid Over Moscow	DOWN	Access/US Gold	9.99
7	Scrabble	NEW	Leisure Genius	12.95
8	Summer Games	UP	Quicksilva	14.95
9	Spy Hunter	NEW	US Gold	9.95
10	Indiana Jones' Lost Kingdom	NEW	US Gold	9.95
11	Hunchback II	DOWN	Ocean	7.95
12	Monopoly	NEW	Leisure Genius	12.95
13	Eureka	UPW	Domark	14.95
14	BMX Racers	NEW	Mastertronics	1.99
15	Eddie Kidd Jump Challenge	DOWN	Martech	7.95
16	Spitfire Ace	NEW	US Gold	9.95
17	Jet Set Willy	UP	Software Projects	7.95
18	Staff of Karna	NEW	Ultimate	9.95
19	Beach Head	UP	Access/US Gold	7.95
20	Boulder Dash	UP	Statesoft	8.95

BUBBLING UNDER

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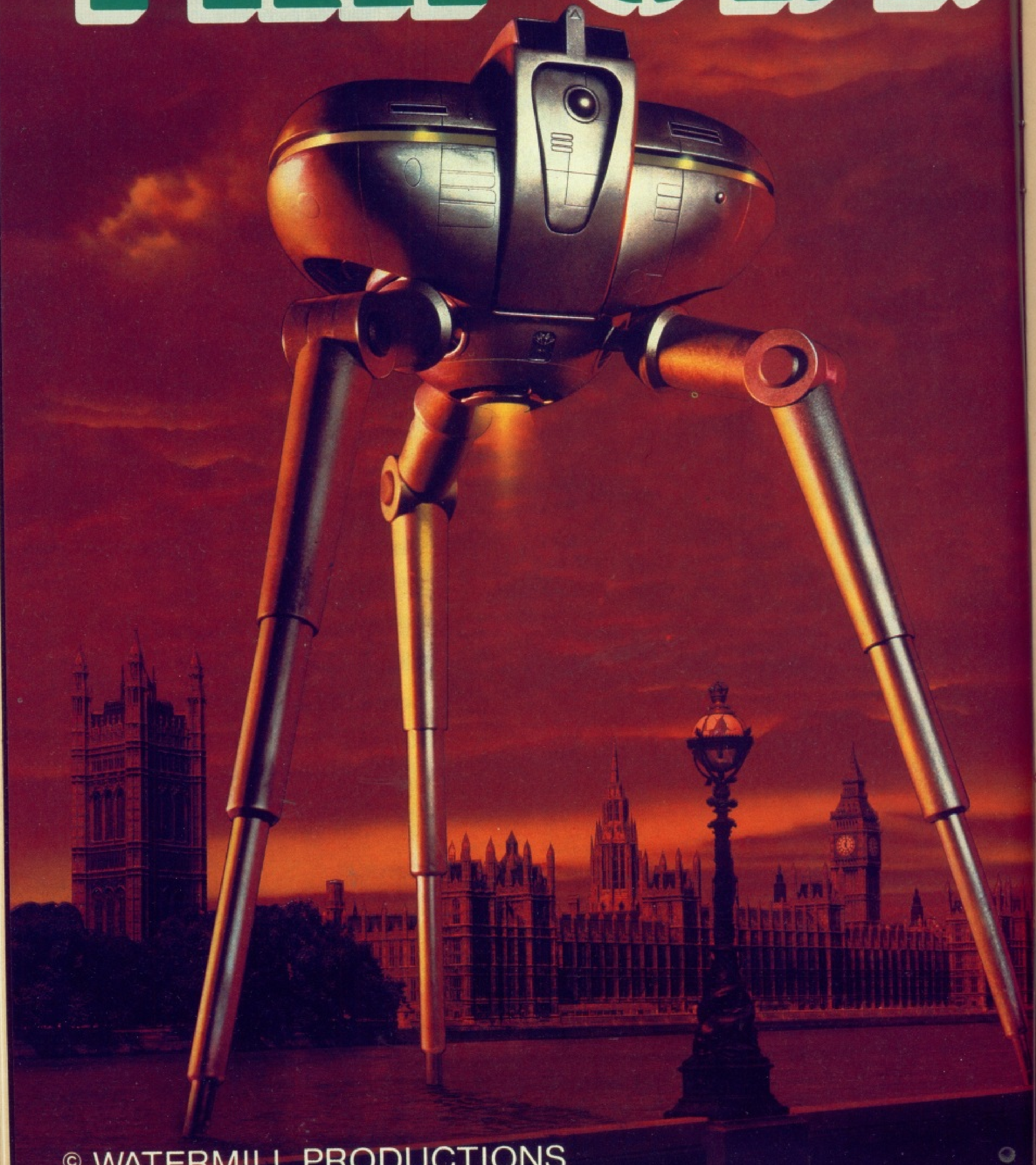

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The lucky winners

RACING 56
Zooming along the motor sport track

GAMES REVIEWS 59
Temperature: Fahrenheit 451

PROFILE 63
Supersoft's Andrew Trott up close

NEW GAMES RELEASES

ARCADE GAMES

Lunattack, (£7.95 cassette), released for C64 by Hewson Consultants, 56B Milton Trading Estate, Milton, Abingdon, Oxon OX14 4RX. Tel: (0235) 832939

1985, (£1.99 cassette), released by Mastertronic Ltd, Park Lorne, 111 Park Road, London NW8 7JL. Tel: 01-402 3316

Demons of Topaz, for C64, (£5.95 cassette); **Gogo The Ghost, Mr Freeze, Exodus, Booty, Headache** and **Zulu**, all for C64; **Snake Bite** and **Mickey The Brickey** for VIC 20, (£2.50 cassette), all released by Firebird Software, Wellington House, Upper St. Martin's Lane, London WC2H 9DL. Tel: 01-379 6755

Shoot the Rapids, (£7.95 cassette), canoeing simulation for C64 released by New Generation Software, The Brooklands, 15 Sunnybank, Lyncombe Vale, Bath BA2 4NA. Tel: (0225) 316924

Break Fever, Empire of Karn, Front Line, Bigtop Barney and **The Caverns of Sillahc**, for C64, (£7 cassette), and **Villain**, for the VIC 20, (£6 cassette), released by Interceptor Micro's, Lindon House, The Green, Tadley, Hants. Tel: (07356) 71145

Kami-Kaze, (£5.95 cassette, £7.95 disk), released for C64 by Supersoft, Winchester House, Canning Road, Wealdstone, Harrow, Middlesex HA3 7SJ. Tel: 01-861 1166

Skyline Attack, (£7.95 cassette), and **PCW Games Collection**, including Omniopoly, Killer Satellites, Micro Mouse and Baby Monty, (£4.95 cassette), both released for C64 by Century Communications Company Ltd, Portland House, 12-13 Greek Street, London W1V 5LE. Tel: 01-434 4241

Spy Hunter and **Tapper**, (each £9.95 cassette, £12.95 disk), by Sega Enterprises, released for C64 by US Gold Ltd, Unit 10, Parkway Industrial Estate, Heneage Street, Birmingham B7 4LY. Tel: 021-359 3020

Commodore 16 Games Pack I and **Commodore 16 Games Pack II** including Minotaur, Snakepit and Letterbox, (£5.95 cassette), released by Melbourne House, Castle Yard House, Castle Yard, Richmond, Surrey TW10 6TF. Tel: 01-940 6064

ADVENTURE GAMES

Magic Sword, (£8.95 cassette and book), for 5-10 year olds, released for C64 by Database Publications, 68 Chester Road, Hazel Grove, Stockport SK7 5NY. Tel: 061-456 8383

Castle of Terror, (£9.95 cassette), graphic adventure for C64 released by Melbourne House, Castle Yard House, Castle Yard, Richmond, Surrey TW10 6TF. Tel: 01-940 6064

The Hulk, Spiderman, Sorcerer of Claymorgue Castle, (£7.95 cassette), text adventures now available for the C16 and Plus/4, released by Adventure International, 85 New Summer Street, Birmingham B19 3TE. Tel: 021-359 0801.

Joystick takes role of paddles

Rushing through rapids in a canoe to avoid the crags and dips along a roaring river is the stuff that makes the latest sports simulation from New Generation Software.

Called Shoot the Rapids, the game uses the joystick or cursor controls to simulate the actions of paddling. Dipping the paddle to the right, for example, moves the canoe in that direction and keeping it leaning in the same direction the canoe moves in a circle.

The player must brave and survive the first course to move on to the next of five levels. Difficulty increases with the appearance of challenging hazards such as rogue speed boats and beavers. The rapids and surrounding countryside race by on a smooth scrolling screen that also shows changes in speed and direction of the current. Cost is £7.95.

Contact: New Generation Software, The Brooklands, 15 Sunnybank, Lyncombe Vale, Bath BS2 4NA. Tel (0225) 316924.

Boogy on down with 64 game

Ballet and jazz dance probably would never make it to the computer screen, but break dancing seems to be just the thing.

In Break Fever for the 64, the player controls "an extremely energetic break dancer, demonstrating his talents to a panel of experienced judges at a prestigious break dancing exhibition." The originators of break dancing probably would be horrified that their down to earth movements are now considered prestigious, but never mind that.

The computer game's sound is "lively electronic funk" and the reverse side of the cassette features a specially mixed audio version of the music to play through any music system – a nice treat from Interceptor Micro's, who is charging £7 for Break Fever. Dancing movements you can make your man do include The Turtle, Back Slam and head spinning.

Interceptor also have backed up their Heroes of Karn adventure game with a sequel, Empire of Karn. The game "legend" concerns an empire that must be saved from a character named Zheff and his followers. Retail price is £7 on cassette, but disks for the second installation are not available.

Front Line, Bigtop Barney and The Caverns of Sillahc are the latest installations in Interceptor's 64 range with the player at the controls of the latest piece of military technology – the Death Tank Interceptor. Among this forboding machine's attributes is self-repairing armour plating. Bigtop Barney is a circus clown who must do four death defying acts to win the applause of his audience. Caverns is set in space where you must steer your ship through the caverns collecting stolen agricultural droids and finally destroy the Sillahc power plant. Each game retails at £7.

The VIC 20 hasn't been forgotten, either. Interceptor just released Villain at £6 to run on the 8 or 16k expanded machines. The player takes the role of a professional crook during hard times, who must avoid the endless pursuits of the determined PC Plodd.

Contact: Interceptor Micro's, Lindon House, The Green, Tadley, Hants. Tel: (07356) 71145/3711.

64 to get Rocky Horror

CRL and its publicity firm are keeping a tight reign on information about their upcoming game with the teasing title, The Rocky Horror Show.

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Richard O'Brien's popular cult film will be available in computer game form by March and on the C64 specifically in late April. The company promises its offering will be "different from anything you've ever seen" with "one or two surprises."

CCI hopes the surprises are as good as the suspense.

Good, clean fun

"Mary Whitehouse needn't worryÿs Supersoft. "It's st possible taste."

The company is talking about its latest game from the author of Interdictor Pilot. The name is Kami-Kaze, but the game is not war – exactly. In fact, it is set in and around a public convenience on the pier at Cleethorpes.

"If anyone is going to raise a stink it'll be the RSPCA," Supersoft says. "In this unusual game you control the alien ship, and must stun innocent bystanders and (horror of horrors) dogs to protect your battle plans."

Available only for the 64, Kami-Kaze sells for £5.95 on tape and £7.95 on disk when disk versions are available.

Contact: Supersoft, Winchester House, Canning Road, Wealdstone, Harrow, Middlesex HA3 7SJ. Tel: 01-861 1166.

Chivalry not dead; just terrifying

You are responsible for reviving the days of chivalry in a new adventure game called Castle of Terror.

Actually, your task is to rescue a beautiful young maiden from the hands (and castle) of a secretive Count. Even before you encounter the dangers within the fortress, you'll face the challenge of simply getting there. Once you've managed to survive the rescue, the ultimate test is whether or not you can get your hands on the hidden treasure.

With a retail price of £9.95 on cassette, Castle of Terror understands multi-word commands and is spiced with "atmospheric music."

Contact: Melbourne House Ltd, Castle Yard House, Castle Yard, Richmond TW10 6TF. Tel: 01-940 6064.

BT launches Firebird

Demons of Topaz, Zulu and Gogo The Ghost are three of the titles that have helped British Telecom launch its line of computer games under the flaming Firebird label.

BT has designed a "Silver Range" of games for the 64 and the unexpanded VIC 20, each retailing at £2.50 with "Gold Edition" titles for the 64 going for £5.95. The first Gold Edition offering is Demons of Topaz, Topaz being a dangerous asteroid. Space traveller Ozzy must search Topaz for the seven jewels he needs to power his spacecraft.

Regular titles for the 64 include Gogo The Ghost, in which the player manipulates the joystick-driven ghost through 150 chambers to rescue his dream princess. Booty is a pirate spree with Jim the cabin boy wandering about collecting the booty. One hundred masks are the valuable prizes in Zulu with the treasure to be collected with the help of a defending force field.

The titles for the VIC 20 are Snake Bite and Mickey the Bricky.

Contact: Firebird Software, Wellington House, Upper St. Martin's Lane, London WC2H 9DL. Tel: 01-379 6755.

Seaside Special Winners

What better to take your mind off the cold snowy weather we have had than £100 to spend on the holiday of your choice, plus a bundle of Taskset games and goodies? Read on to see if you are among our winners

In our recent Seaside Special competition we listed 10 coastal places and asked to tell us what they were famous for. ME Ventham of Radlett, Herts was the first person to send us the 10 correct answers qualifying for our first prize of a £100 voucher to spend with any major travel agent on the holiday of his choice. Plus a range of Taskset games, T-shirts, posters and other assorted goodies.

The 10 runners up, who each receive a selection of Taskset games, T-shirts and goodies are: R Palmer of Stafford; Martin Younger of Stockport, Cheshire; Freda Taylor of Stockport, Cheshire (must be where all the masterminds live!); Mr and Mrs P Ellis of Worthing; C Rowland of Portsmouth, Hants; Colin Bray of Haywards Heath, West Sussex; Mrs T Dutton of Westerham, Kent; Mrs S Bunting of Bakewell, Derby; R A Mascall of Thornbury, Bristol; and David Carpenter of Southampton, Hants.

Unfortunately Taskset ran across unforeseen problems with Seaside Special and were unable to market the game at the last moment. CCI would like to join with Taskset in apologising for any disappointment this may cause. However, the selection of games our winners receive from Taskset will be every bit as good.

Next month we will be announcing the winners of our music competition and our Gold Collection competition.

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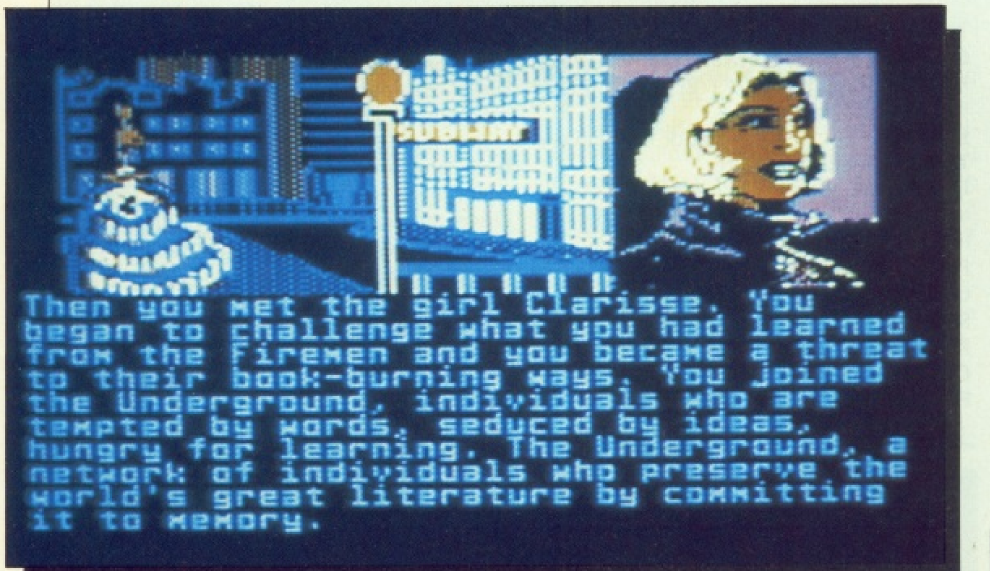
Heat of the moment

Ray Bradbury's Fahrenheit 451, guaranteed to raise your temperature, leads this month's selection of recently-released games



```
Then you met the girl Clarisse. You
began to challenge what you had learned
from the Firemen and you became a threat
to their book-burning ways. You joined
the Underground, individuals who are
tempted by words, seduced by ideas,
hungry for learning. The Underground, a
network of individuals who preserve the
world's great literature by committing
it to memory.
```

Title: Fahrenheit 451
Programmer: Michael P Myer
Company: Trillium Corp, distributed by WHS Distributors, St John's House, East Street, Leicester LE1. Tel: 0533 551196
Hardware: 64, disk drive
Type of game: Adventure
Description: Find a way to vindicate the futuristic government's book burning campaign and bring information back to Manhattan
Fast loader: N/A
Graphics: ****
Sound: *****
Playability: *****
CCI Rating: *****
Price: £19.95 (disk)

All games reviews appearing in this magazine are personal opinions and serve only as a guide to new games on the market. Our star ratings for graphics, sound, playability and the CCI rating are as follows:

*** = Poor**
**** = Average**
***** = Good**
****** = Very good**
******* = Excellent**

FAHRENHEIT 451

The genius of Ray Bradbury has been transferred to the computer, perhaps inevitable but not necessarily good — except in this case. This offering from the new Trillium science fiction line of interactive literature is an intriguing combination of all those traits.

The science fiction lets your imagination wander and try new avenues, so to speak, considering the setting is New York's Fifth Avenue "not too long from now." And Fahrenheit 451 interacts with the player by adjusting results to the commands it gets making a more sophisticated game than those with only one way of solving the often very complex puzzles.

The plot of Fahrenheit 451 actually is a continuation of the book of the same name. The player is a former fireman Guy Montag whose job was, ironically, to start fires destroying books and any source of information. But Montag becomes enlightened and now wants to bring book knowledge back to the people. He is aided by a mysterious underground organisation with the same objective, the members of which appear occasionally to help their protege realise the dream.

Aside from the genius of Fahrenheit 451's plot and technique, it's also good fun. You can draw a map of Manhattan for yourself to keep track of where you are, where you have been and where you want to go. Or you could do it simply for amusement's sake. But it is quite useful as you, controlling Montag, move surreptitiously about — "the most wanted fugitive in the country." Your route encounters buildings, plazas, fountains, potholes and, if you go wrong, the dreaded mechanical hounds whose spine-chilling spider legs and needle tongue are the death of the establishment's enemies.

What makes this adventure outstanding is the script, meticulously created and detailed with vivid, complete descriptions and a surprise around every corner — storytelling the way it should be.

If you get to a certain point in any direction, you are switched to the next disk. (This presents a small hitch, though, because the program instructions to switch to a new disk actually means side one, two, three or four of the two 64 disks. We would have liked to see this explained to users.)

A large vocabulary is outlined in an accompanying hint book, a tribute to Fahrenheit 451 because it doesn't rely on hours of word searching to keep the player occupied or puzzled. Graphics and sound effects are plentiful and colourful, though they don't add much to the contents. On the other hand, the contents don't need them. The thinking behind it speaks for itself.

PERILS OF BEAR GEORGE

The campaign to boost teddy bear awareness cannot help but be boosted further by this charming new game from Cheetahsoft.

Bear George's walk may remind you somewhat of the Hoffmeister bear of television advert fame, but George doesn't hang out in pubs. In fact, he'd like to take his annual winter nap so he's storing up energy (fat, in other words). To do that he has to catch apples falling from the trees to store as much energy as possible. After that he has to make his way to the cave, avoiding collisions with skiers and the ambitious zookeepers who want to add Bear George to their collection. And on the story goes.

Teddy Bear's Picnic and Coming 'Round The Mountain are two of the delightful tunes that follow you along the path. Among the great animated graphics is a bit when a skier crashes into Bear George and the two tumble along to where George started. When one of him keels over for good, there are a few other cute little Bear Georges waiting patiently on their stools to take his place. Several different levels increase in difficulty as you progress through each year of Bear George's life.

Title: Perils of Bear George
Programmer: Timedata Ltd
Company: CheetahSoft Ltd, 24 Ray Street, London EC1. Tel: 01-833 4733
Hardware: 64, cassette recorder, joystick or RAT Infra-Red Joystick optional
Type of game: Arcade
Description: Gather apples to give you energy to survive a winter in hybernation
Fast loader: Yes
Graphics: ****
Sound: **
Playability: ****
CCI Rating: ****
Price: £6.95 (cassette)

RHYMELAND (MY FIRST ADVENTURE)

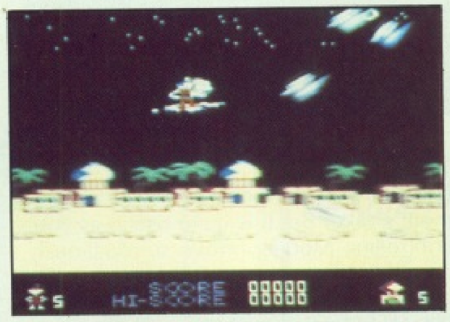
Little Bo Peep needs to find her sheep. Jack and Jill must fetch a pail of water. These delightful nursery rhyme characters help introduce the novice to the concept of adventure games with simple but fun problems that must be solved in the way of adventures.

Anirog recently took over marketing of this helpful and entertaining introduction to adventure games originally produced by Jolly Rogers Software (An indication of the power of advertising money in selling a game — pity.) Though graphics are simple and sound effects are only token "take" sounds and exaggerated "drop" noises, Rhymeland is effective for its purpose — to get young children started in the thinking processes required for adventure games.

The simple vocabulary and subject matter remain within the grasp of youngsters, while the program design reinforces correct spelling by not allowing abbreviations. Directions of movement are the standard north, south, east and west and players are encouraged to draw a map as they move around.

Unfortunately, the simple drawings that make up occasional graphics don't add much to the player's progress and items in possession or in sight are not shown. Worse yet, the potentially colourful nursery rhyme characters never actually appear on screen. The long loading time also requires a bit of patience. Nevertheless, this relatively easy game coaxes the player onward and a little tune rewards you when you have helped a forlorn character. Good choice for a first timer.

Title: Rhymeland
Company: Anirog Software Ltd, 29 West Hill, Dartford, Kent DA1 2EL. Tel: 0322 92513
Hardware: 64, cassette unit or disk drive
Type of game: Adventure
Description: Journey through Rhymeland meeting and helping the familiar characters with their problems
Fast loader: None
Graphics: **
Sound: **
Playability: *****
CCI Rating: ***
Price: £5.95 (cassette), £9.95 (disk)



JINN GENIE

From the animated little feet to the banded turban on his head, the hero of Jinn Genie is a delightful subject to watch.

The floating movements of the flying carpet and flickering stars in a night sky also are among the many clever ingredients of this fun catch-em game in which the player controls the young genie who must find the evil Ilfreet inside his palace and remove the spell that has been cast over Arabia's Golden City. The first feat is to get to the city, this being done with the aid of your magic carpet and the Sphere of Oblivion that sends the vicious little flying devils ... well, flying.

Once at the palace, you must outwit the guards and scale the courtyard wall to a window.

Sensitive reaction to joystick commands is one of the refreshing elements of Jinn Genie. The flying carpet moves quickly forward and back with precision and the Sphere of Oblivion sweeps just in the direction you give it. (Of course, that means you don't have an excuse if you goof!) Such joystick sensitivity is quite crucial considering the naughty and aggressive nature of the little devils.

Jinn Genie offers a pause mode and lively Arabian music as well as continuous action even if you lose one of your lives. Once you've lost all five, of course, it's back to the drawing board ... or the carpet landing strip, as it were.

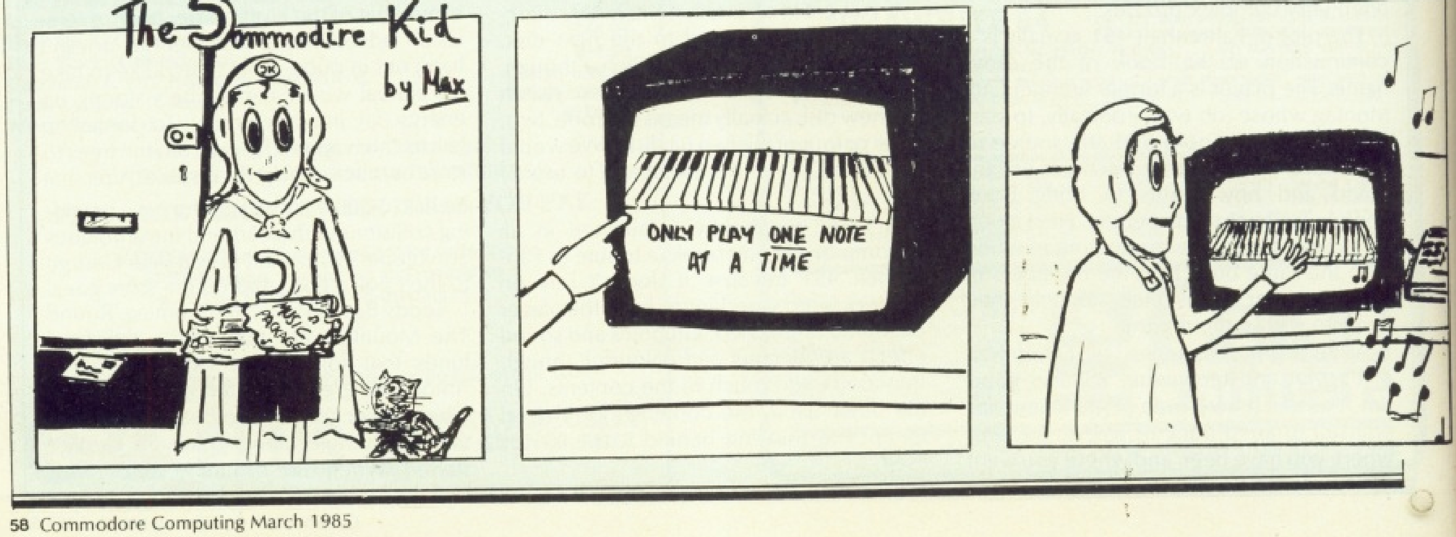
Title: Jinn Genie
Programmer: Hanan Samara
Company: Micromega, 230-236 Lavender Hill, London SW11 1LE. Tel: 01-223 7672
Hardware: 64, cassette unit, joystick optional
Type of game: Arcade
Description: Fly on magic carpet to palace to find the Ilfreet inside and capture him in the Magic Jar
Fast loader: None
Graphics: ****
Sound: ***
Playability: ****
CCI Rating: ****
Price: £8.95 (cassette)

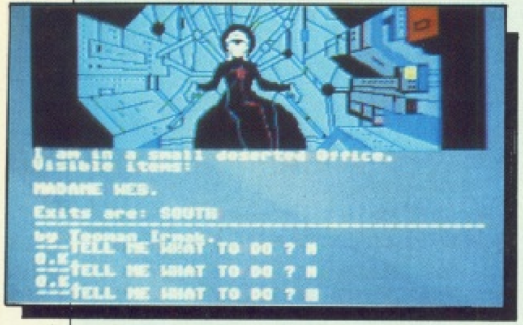
SPIDER-MAN

More mysterious, menacing, intriguing characters of Marvel Comics come to the computer with Scott Adams' Spider-Man.

Hydraman turns into water, Sandman turns into sand, Madame Web (no, not into webs) "scans" the future and the Lizard wields his awesome tail in this marvellous Marvel, if you'll pardon the not-so-original pun.

(continued on page 65)





```
I am in a small deserted Office.
Visible items:
MADAME WEB.
Exits are: SOUTH
------------------------------------
by [illegible]
---TELL ME WHAT TO DO ?
O.K
---TELL ME WHAT TO DO ?
O.K
---TELL ME WHAT TO DO ?
```

As the player, you control Spider-Man's antics, whether he is solving some mystery or simply wandering about the ceiling. (The latter is an amusing thing to do when you can't think of the next move.)

As an adventure game, Spider-Man keeps you moving along corridors, into a bevy of different rooms each of which hold a surprise.

Responses also feature touches that set this game apart, including full sentence interpreter and clever replies like, "I must be stupid, but I just don't understand what you mean." The text is challenging but still encourages you to move further along (mainly because there are lots of chances to go wrong, so you see a lot without getting very far).

Graphics fulfill our expectations of high quality from Adventure International, though you have to perform a few tricks to actually make your hero appear. The 3D effects are particularly good in small spaces such as an elevator shaft, and extensive use of bright colours in detailed drawings makes characters such as Lizard all the more vivid.

Title: Spider-Man
Programmer: Scott Adams
Company: Adventure International (UK), 85 New Summer Street, Birmingham B19 3TE. Tel: 021-359 0801
Hardware: 64, cassette unit
Type of game: Graphic adventure
Description: Control Spiderman
Fast loader: Yes
Graphics: ****
Sound: N/A
Playability: ****
CCI Rating: ****
Price: £9.95 (cassette)

QUINX

The thought of slimy ink worms munching their way across your paper is quite horrible — definitely the stuff of nightmares. The rather simple concept of stopping them presents the basis for Quinx.

Despite the eating mechanism that might remind you of PacMan, this game is nothing like it and quite original. While you are chasing the worms on the A4 size writing paper, for example, you can eat any little goodies that pop up on the left side, but the nasty dentist will come drag you away if you don't brush your teeth with the toothbrush on the right. A bottle of Tippit correcting fluid is also at hand so you can cover up the trail left by the worms, who get their ink from a generous pot.

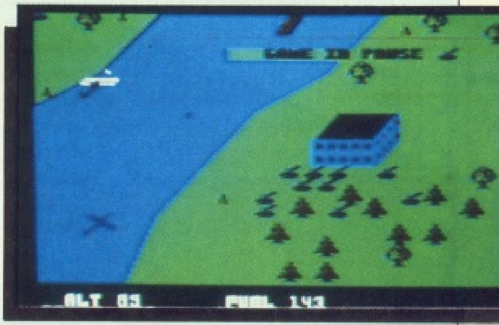
There is also a telephone, but you'd better be cautious about answering it since it may not be good news you hear on the other end. All these hazards make for a harrowing but fun time during poor Arthur Crowe's nightmare. Good graphics and sound, such as a ringing, vibrating telephone, help make the game more than a simplistic catch 'em spree.

Title: Quinx
Programmer: Andrew Trott
Company: Supersoft, Winchester House, Canning Road, Harrow HA3 7SJ. Tel: 01-861 1166
Hardware: 64, cassette unit or disk drive, joystick optional
Type of game: Arcade
Description: Race to keep as much of your piece of paper intact by stopping the voracious ink worms
Fast loader: None
Graphics: ****
Sound: ***
Playability: ****
CCI Rating: ****
Price: £6.95 (cassette), £8.95 (disk)

BLUE MAX

The hummmm-sput-sput-hummm-sput-sput sound of the by-plane is just one of the delightful treats in store from Synsoft's new Blue Max.

Firing guns, dropping bombs and the engine noises highlight this tidbit of gleeful destruction set in World War I. It's hard to say what makes Blue Max so much fun. Perhaps it's the pleasant, detailed scenery below with trees (two different kinds, at that), bright blue rivers and bridges that are more than lines across the screen. The game even has cars and lorries driving across the bridges and steamers rolling down the river.



Blasting the buildings below is more fun than ever before; you actually see the structure disintegrate, though the claim to being in real time doesn't hold here for obvious reasons. The screen flashes with colour to warn you of an impending hit on your own plane or of other dangers. And if you think the scene is sunny for some reason, it's because there's a shadow of your plane on the ground.

You must use all your flying skills and weapons to shoot down enemy planes, bomb targets and strafe gun tanks. Diagonal scrolling gives a unique approach to movement.

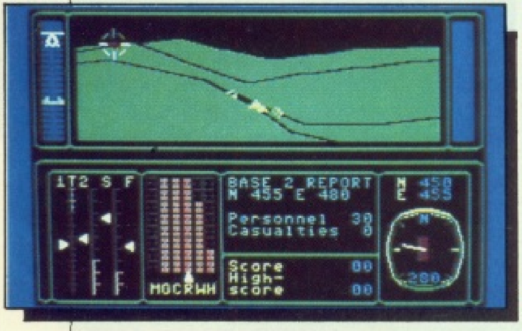
Title: Blue Max
Programmer: Peter Adams
Company: Synsoft, distributed by US Gold, Unit 10, Parkway Industrial Estate, Heneage Street, Birmingham. Tel: 021-359 3020.
Hardware: 64, cassette unit or disk drive, joystick essential
Type of game: Arcade
Description: The pilot of a by-plane must fight the Axis powers ending with a final assault on three specially marked targets
Fast loader: Novaload
Graphics: ****
Sound: *****
Playability: ****
CCI Rating: ****
Price: £9.95 (cassette), £14.95 (disk)

YEAH! YEAH! YEAH!
d*€&$!
Max

COMBAT LYNX

This game is not meant for those of you who pop a game into your computer just for a few minutes of mindless play. First, it takes much more than a few minutes even to get your feet on the ground, much less your helicopter in the air. Secondly, Combat Lynx is anything but mindless.

That is what makes this foray into battle so good. Written entirely in machine code, the contents take up every bit of the 64's memory. That and the help from Westland Helicopters in designing the technical side of Combat Lynx all are evident from the first screen.



While graphics are not the most stirring, they don't really need to be. Scenes are ever-changing and so are the conditions of battle — all factors that must be taken into account during play and are registered on the guages at the bottom of the screen. Your mind is constantly switching from various considerations such as height, direction and speed of flight not to mention the array of weapons at your disposal for shooting down a range of targets also of your choosing.

The result is a set of very busy fingers. Combat Lynx can be played either with the keyboard (nearly 30 keys, some of them doubling functions) or with two joysticks. We would suggest the latter or perhaps a combination of one joystick and the keyboard.

Beyond simply flying, you have a mission to support four bases with air cover, meaning you attack enemy aircraft, tanks, etc. To do that, you must find them on the intelligence map, pinpoint their specific location, arm your Lynx's weapons system and get to your target. Then and only then can you shoot. Phew!

Games addicts looking for something more challenging will get long hours of concentrated challenge out of Combat Lynx. This is no task for the impatient or for the amateur gamester. Sound effects are essential since they warn of impending danger, be it an enemy tank homing in on you or an overheated engine. The intelligence map is of some help in locating friends and foes despite its rather simplistic form.

Title: Combat Lynx
Programmer: Ron Jeffs
Company: Durell Software, Castle Lodge, Castle Green, Taunton, Somerset, TA1 4AB. Tel: 0823 54489
Hardware: 64, cassette recorder, one or two joysticks (optional)
Type of game: Arcade
Description: Support ground forces in complex Lynx helicopter equipped with wide range of weapons
Fast loader: Yes
Graphics: ***
Sound: ****
Playability: ****
CCI Rating: *****
Price: £8.95 (cassette)

SWISS FAMILY ROBINSON

Fritz and his family are stuck on a ship run aground by a storm off the coast of an island. You play Fritz, the oldest son, who must gather food, find shelter and protect your family from the hazards of shipwreck life, all the while seeking a way to be rescued.

Terrific graphics that change as you add and take away items along with complete sound effects from waves lapping the shore to wood being sawed are among the treats in store for young adventurers.

Swiss Family Robinson is one of a line of computer adventure games put out by the American company Windham Classics, a spin-off of Spinnaker Software. All are based on classic novels for young people such as Gulliver's Travels, Below the Root and this one.

Based on the book by Johann Wyss, the computer game is a good way to introduce teenagers to literature as well as making them reason and gain some general knowledge. A book that Fritz holds, for example, can be opened (an action that also appears in a strip at the bottom of the screen displaying items in your possession) to give interesting facts about plants and animals you encounter along the way. A map will trace your path and a help key gives hints about available vocabulary. The game also allows you to store games as played and includes a complete guide that details a bit about the book and author.

All this and colour, too, both on screen and in the sound effects. The island, though barren at first sight, is alive with water and plant and animal life such as aloe plants and prancing ostriches.

All around a well-done, entertaining game that doesn't skimp just because it is aimed at less experienced adventurers.

Title: Swiss Family Robinson
Programmers: Tom Snyder Productions
Company: Windham Classics Corp, distributed by WHS Distributors, St John's House, East Street, Leicester LE1. Tel: 0533 551196
Hardware: 64, disk drive
Type of game: Graphics adventure
Description: Find a way to get yur stranded family rescued while providing food, shelter and protection
Fast loader: N/A
Graphics: *****
Sound: *****
Playability: *****
CCI Rating: *****

INDIANA JONES

The less-than-peppy opening theme for this film spin-off game is the first of several mild disappointments in Indiana Jones.

We had hoped that this game from Mindscape would follow in the footsteps of several television and film-based computer games offering excellent graphics, sound, challenge and entertainment to do their namesakes proud. Unfortunately, Indiana Jones In The Lost Kingdom doesn't quite live up to its name, though it certainly is still worth a determined try.

The inlay card warns you of the major problem you'll encounter — NO RULES. "Nobody told Indiana Jones the rules. And no one will tell you," the sleeve says. So what it boils down to is a lot of luck and a good knowledge of how a games programmer's mind works. The few directions that are provided talk of logical thinking, problem solving skills and intellect. This is true to some extent in that you have to figure out the "rules" in each room by changes in the score, the surroundings, moving figures, etc.

Indiana Jones certainly does test your imagination, something often difficult to do with arcade games that tell you what to do and only test your ability to follow instructions effectively. The Lost Kingdom has six rooms or caverns, each of which tests your thinking skills in a different way. The game can be played by one or two people, the latter of which probably would be much more fun.

Perhaps the biggest disappointment in Indiana Jones is the graphics which look nothing like a "dense, tangled, mosquito-infested jungle" and more like the geometrically maze blocks we've seen in numerous other average computer games. The redeeming feature is the character of Indy, which is clearly drawn despite its unexcitingly small size and fully-equipped with working whip, machete and that endearing floppy hat.

A standard, albeit challenging, computer game was not the thing to do with a brilliant character like Indiana Jones. But if you are not expecting the Lost Kingdom to be delivered in 3D to your home, you can still have a great deal of fun figuring out the method of the Kingdom's madness.

Title: Indiana Jones In The Lost Kingdom
Programmer: Michael J Hanson
Company: Mindscape, distributed by US Gold Ltd, Unit 10, Parkway Industrial Estate, Heneage Street, Birmingham B7 4LY. Tel: 021-359 3020
Hardware: 64, cassette recorder, one or two joysticks
Type of game: Arcade
Description: Make your (Indy's) way through the Lost Kingdom's myriad of surprises relying on luck and imagination — but no rules
Fast loader: Novaload
Graphics: ***
Sound: ***
Playability: ****
CCI Rating: ***
Price: £9.95 (cassette)

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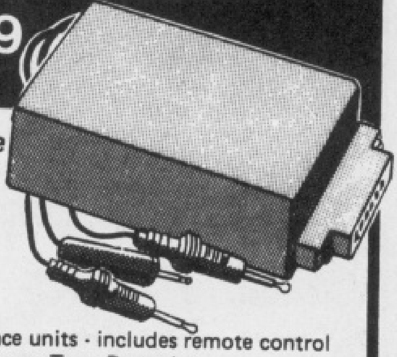

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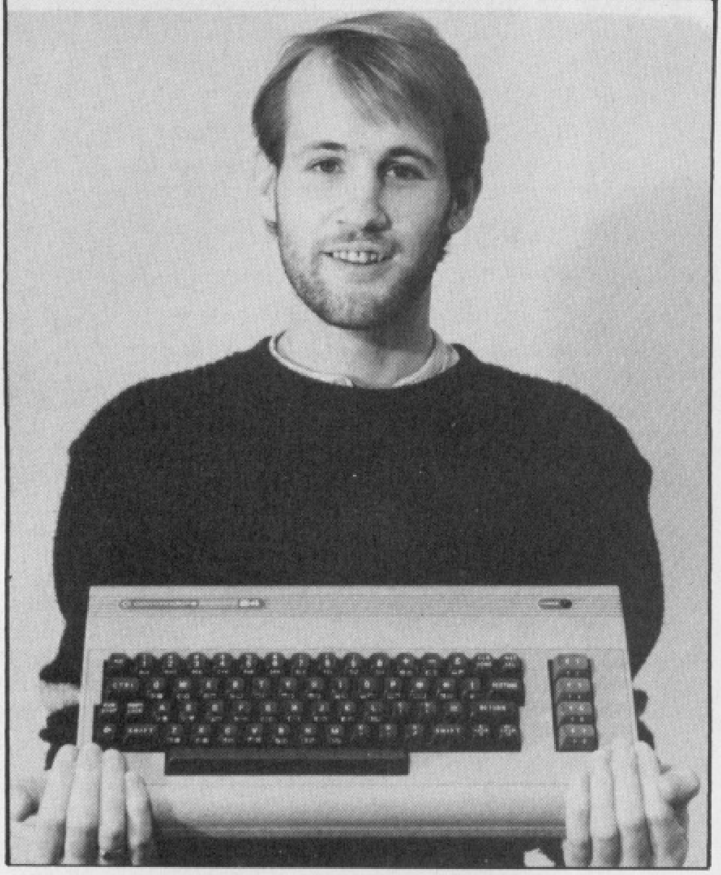
Meet Mikro Man

Sue Pearce talks to Andy Trott — the man who has made the lives of many programmers easier with his Mikro assembler, and to Supersoft who market his products

ANDREW TROTT — MIKRO AUTHOR



Although still in his early twenties, Andy Trott could well be called an old man of the computer industry, responsible as he is for early PET software including the Space Invaders chip which was inserted into many a PET.

Andy is also the author of the popular Mikro assembler.

"I started on the PET about six years ago when I was at college," recalls Andy.

"I didn't do much work at college after I had discovered computers — it's like being addicted to smoking!"

In his early days of programming, Andy soon became sick of Basic assemblers and so he wrote a machine code assembler. His dad persuaded him that it was good enough to market which is how he first became involved with Supersoft.

Called Mikro, Andy has now converted his assembler onto other machines.

Andy says: "Whereas with games you need a lot of imagination, with Mikro it was just the knowledge and programming ability."

Not that Andy is lacking where imagination is concerned. His latest game Quinx is very original (see this month's games reviews).

"When computers first took off my own feeling was that copies of arcade games sold better than originals. People wanted the arcades in their homes. Then I decided to write original games," comments Andy.

He continues: "I can start a game and almost get it finished in one month, but I tend to lose interest and it takes another month or two to finish."

Andy is of the school who type straight into the computer without writing masses of code down on paper. "That's one of the benefits of Mikro," says Andy smiling.

Aside from computers, Andy's other great love in life is music. He is trying to combine these two interests through the design of a sound sampler system based on the Fairlight.

Although in favour of computerised music, Andy feels that it should be limited to the home. He says: "I can appreciate some-one playing a synthesiser, but it lacks atmosphere. You can't get a computer to sound like the real thing."

SUPERSOFT

Supersoft, one of the oldest software houses, was started as a hobby.

Directors Peter Calver and Pearl Wellard were both accountants when they first encountered computers.

Peter says: "Our company decided to install a computer system. Although we had no previous knowledge of computers, Pearl and I ended up designing the system."

At the end of 1978 they acquired an 8K PET with ROMS with the intention of writing programs and selling them, just as a spare time hobby.

"There wasn't software for the PET in those days," says Peter. "There were only about 1000 PETs in the country."

Supersoft was the first company to supply software to Petsoft. After 18 months Peter and Pearl decided to give up their jobs and make Supersoft a full-time concern.

Pearl comments: "Our main intention originally was to make money out of business programs."

"It suddenly went from being just a hobby to being something that could bring us income," adds Peter. "Our turnover in the first year was £2000 — in the second year it increased to £100,000. After press coverage people started approaching us."

Many PET owners will be familiar with one of Supersoft's early products, the Space Invaders ROM. Still one of the only software houses devoting any real attention to PET products, Supersoft has diversified to produce games and utilities for a wider range of computers.

One of Supersoft's best and steadiest selling products is the Mikro assembler, popular with many programmers and written by Andy Trott.

Pearl Wellard and Peter Calver

Take to the road

Now's your chance to break the speed limit — legally! Sue Pearce gets to grips with a selection of motor sport games to try and prove the legend of women drivers false

TURBO 64

Turbo is the name and turbo-action you certainly get! Though I hate to say it, this game went a long way towards establishing some truth in the myths about women drivers. I just could not stay on the road! However, I must add that male colleagues trying to prove their superiority didn't do much better!

So, lightning reactions and a sensitive joystick are called for if only to avoid the ghastly scrunching noises when your car leaves the road.

Constantly changing scenery adds to the excitement of the game, from the hills in the distance to the road signs which suddenly leap up at you and you speed around the track.

Several options are offered by Turbo 64: car, racetrack (from Loonies Loop to Devil's Deathtrack), number of players, automatic gear change or regular shift. You can also choose whether to compete using the keyboard or a joystick. Personally I prefer using the joystick as I find it gets you more involved in the game. Also you don't end up in that great race track in the sky just because you hesitated over which key to press.

Contact: Limbic Systems, Hensington Road, Woodstock, Oxford. Tel: 0993 812700.

CCI
39
CCI
39

POLE POSITION

Ever since the arcade version of this game was discovered in a pub near our old offices, Pole Position has been a favourite among the staff here.

Addictive is certainly the word for this game. As soon as the flag is up, the race is on. Your first spin around the track determines your placing on the starting line.

You have a choice of tracks to race on, including a practise track with no competitors to avoid. The graphics are good with starting flags and banners strung across the track. You are in the driving seat, and the scenery is constantly changing as you progress in the race. The sound is also effective with the roar of the engine changing as you go into top gear (the choice of gear is limited to high and low).

Your speed and best lap time is indicated at the top of the screen and congratulatory messages appear at appropriate moments. One of the incentives with Pole Position is the battle to get your name up on the high score.

Contact: Atari, Atari House, Railway Terrace, Slough, Berks. Tel: 0753 33344.

DAREDEVIL DENNIS

This one's stretching the boundaries of motor racing somewhat, but I couldn't resist including it as it's a delightful game. Besides, our hero Dennis does spend much of his time doing daredevil stunts on his bike to recover the torn up pieces of his Oscar.

The game wins you over right from the start with several screens of witty instructions and Dennis' history.

Here Dennis is about to perform his last stunt. On the way to the film set he has to leap up and pop passing balloons, avoiding crushing flowers underfoot (the director loves flowers). Next he has to perform hazardous stunts on his bike avoiding obstacles such as fires and trees.

A nice touch here (maybe I'm just blood thirsty) is the sight of Dennis if he does come a cropper. He is thrown from the bike and lands head first, legs waving in the air.

If you can help Dennis succeed, he is guaranteed in the next Speilberg epic, "Riders of the Lost Awk"!

Contact: Visions, 1 Felgate Mews, Studlands Studio, London W6. Tel: 01-748 7478.

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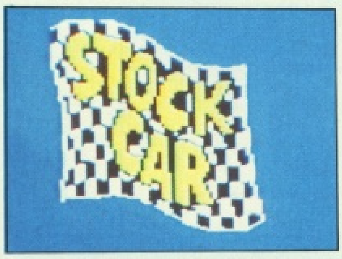


Stock Car displays the entire race track at one time, so you are watching the position of your car rather than feeling that you are in the driving seat. For the fainter-hearted armchair racing drivers, the feeling of being an observer rather than a participant combined with gentle bumps rather than guaranteed death may keep your blood pressure down.

The top of the screen displays your gear, the number of successfully completed tracks and your speed. This is useful if your eyes aren't glued to the track. It's also something to pass the time when your car is wedged against a bend in the barrier and you are attempting to get back onto the track!

If you win a race you can enter your name on the hi-score table. Even if you lose you can get your name up if you get the best lap time.

Contact: Micropower, Sheepscar House, 15 Sheepscar Street South, Leeds. Tel: 0532 434 006.

HYPER BIKER

One of the first things that strikes you about this BMX spectacular is the chatty documentation sheet which comes with it. After discussing the perils of wipeouts and loop outs, you are informed that Hyper Biker has been honed to the same precision as your BMX cycle so "Ride like a wally and you'll loop out for sure"!

Pedal power, handlebar control and brakes have all been taken into account to ensure a realistic ride. It is advisable to spend some time getting to grips with various controls of your bike before entering events. For the reckless, there is even the ability to perform wheelies.

Events which can be chosen include Straight Race, Obstacle Race, Wheelie Race, Long Jump, High Jump and Bunny Hop. This means that you will be able to enjoy Hyper Biker for some time without tiring of the same challenges.

before each event a starting table is displayed indicating the nature of the competition and the names of competitors. A helpful feature here is advice which flashes up for each event. The game also pauses between each event.

As the cover sleeve says, Hyper Biker has 'berm power'.

Contact: PSS, 452 Stoney Stanton Road, Coventry CV6 5DG. Tel: 0203 667556.

BURNIN' RUBBER

One of the earliest racing simulation games for the 64, we featured Burnin' Rubber in the CCI Master Gamer competition held at the last Commodore exhibition, where it proved very popular.

The version found in the arcades has also always drawn the crowds. Here you are an entrant in the Intergalactic Four Seasons Death Race. Why Intergalactic? Maybe because you are racing for your life against indestructable Tank Drivers and the Deathmobiles. Still the idea is the same as many racing simulation games except that you move pretty swiftly as you pass through four seasons — spring, summer, autumn and winter (indicated by different conditions off the road).

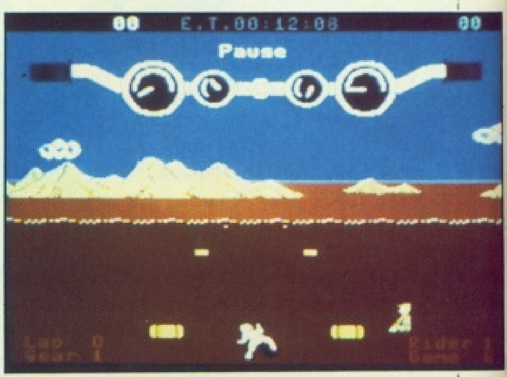
you also have the ability to fly (in Herbie fashion) over competitors.

The ever changing scenery and tricky opponents make Burnin' Rubber fast moving and absorbing. Again you will need lightning reactions and a sensitive joystick to avoid a violent death.

Contact: Audiogenic, PO Box 88, Reading, Berks. Tel: 0734 664646.

MOTOCROSS

An amusing motor bike racing simulation. The graphics are limited but nice, with a little man wandering onto the screen to wave his flag and start you on your way. Your rider is a squat character sitting on his bike waiting for the off. A lovely touch is the fact that when he is stationary, he props himself up with one leg on the ground — very realistic.



Although these graphics are good, it is a shame that the programmer decided to limit the scenery. Hills in the background (why are there always hills in the background?) don't change much apart from scrolling slightly from side to side as the race track bends. And no matter how fast you go these hills never seem to get any nearer!

In addition to observing your little rider, you also have handlebars at the top of the screen displaying dials showing your speed.

There are obstacles to be avoided on the race track including haystacks strewn across your path.

Sound is also worth mentioning with the steady purr of the engine. Motocross was slightly easier to get to grips with than some of the other games reviewed here, but still presents an enjoyable challenge.

Contact: System 3, Southbank House, Blackprince Road, London SE1. Tel: 01-587 0873.

KIKSTART

"This is a sheepless, non-violent and original game," says the title page of Kikstart. Sheepless and original yes, but the sight of the rider being hurled off his bike and spinning through the air might well be considered by some to be violent — although there is no blood!

You have to select three courses out of a choice of six. Obstacles which have to be overcome include buses, cars, van and water — all of which have to be leapt over in Eddie Kidd style.

The graphics are very realistic and colourful with ramps leading up to obstacles. Another nice touch to this game is the ability to do wheelies with your bike.

Kikstart is realistic in that you have to react to circumstances in the same way that you would in real life. For example when you hit rough ground, you must go slowly or you will be thrown off your bike. Alternatively when faced with tyres, hedges or barrels you must speed up.

A catchy background tune can be switched off if desired. You can choose between controlling your bike with keybaord or joystick and there is also the option of one or two players.

Contact: Mr Chip Software, 1 Neville Place, Llandudno, LL30 3BL. Tel: 0492 79026.

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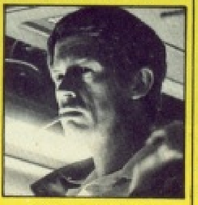

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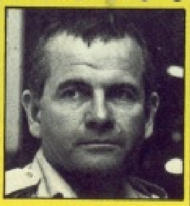

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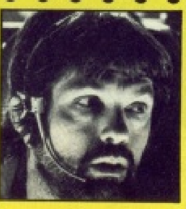

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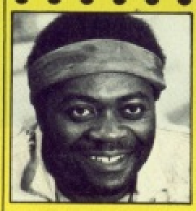

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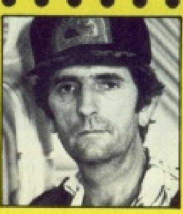

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Eradicating errors

One Paul Ehrlich said, "To err is human. To really foul things up takes a computer!" When writing computer programs the programmer needs to be fully aware of the almost unlimited opportunities for the propagation of errors.

David Bowdrey wades through numerous errors starting, this month, with those introduced through a programmer's working methods and the coding practices employed

That the computer appears to be an intelligent machine with an apparently high level of mathematical ability only serves to lull the unwary into a false sense of security. By ensuring that a program is well designed in the first place and then coded in a methodical manner, a programmer has a fighting chance of producing a sound error-free program.

With the problem of errors foremost in mind, the one practice which is of great benefit is that of ensuring total control of the computer at all times. Adopting a programming style that ensures that every step of the program is fully specified lessens the opportunities for spontaneous errors.

There are two groups of errors. Firstly those that the programmer introduces through his working methods and the coding practices employed — the errors of commission. And secondly those that the programmer allows to happen, generally by insufficient attention to detail — the errors of ommission. (We will look at these next month.)

Syntax errors are not the subject of this article. The computer will highlight such errors and a sound knowledge of the BASIC resident in your computer will be gained in their correction. Once that knowledge has been gained then correcting syntax errors should play only a small part in your programming efforts. But as a pronouncement in flawless English is no guarantee of its validity so it is that s syntactically perfect BASIC statement is no guarantee that it will solve the problem for which it is written!

ERRORS OF COMMISSION

NUMERIC

Errors in this family fall into two general groups. The first group relates to the type of mathematical method used, effectively the formulae employed. The second group relates to the actual numbers used, the question of their precision.

Formulae

The use of the wrong formula in the strictest sense of the term is the most obvious way to introduce an error within this group. Using, for example, the conversion formula from degrees Fahrenheit to degrees Centigrade (Celcius) when converting from Centigrade to Fahrenheit may produce some plausible results but they would be most definitely wrong!

Fortunately, such a mistake would be readily identified. Trial of the well known conversions of the freezing and boiling points of water would quickly highlight the presence of the error. Such is not the case when far more detailed and complex formulae are misapplied. Bear in mind that an error in the transcription of a given formula is tantermount to using the wrong one in the first place. The transcription error may not be in your copying of it, or your conversion of it into BASIC. The fault could lie in the original type setting of the reference source.

The solution to this form of error is twofold. First, research your choice of formula thoroughly. Choose the simplest form or a combination of lesser formulae. Obtain a second independent reference to the formula if practical. (At worst a second mention in the same text book should eliminate concern over type setting errors.) Second, test the chosen formula against longhand calculation if at all practicable, but most certainly test the formula as encoded in the program to ensure that it functions as intended. The more complex the formula the more detailed will the testing have to be.

Where the program is intended to have commercial worth, the choice of the wrong formula could spell financial disaster.

The poor use of round brackets can radically effect the meaning of a given BASIC formula. This poor use covers not only the over use but also the under use. When Boolean logic has been used in a BASIC statement it is imperative for the health of the program, not only at its inception but also for any future maintenance, that round brackets are used so as to completely clarify any expression. Whilst the computer may not need the brackets in order to execute the statement, the absence of a pair of brackets may completely change the sense of what was intended. Future changes to the program may be difficult or corrupting because the structure of the expression may have been forgotten and its presentation ambiguous. When in doubt put it in brackets.

When a formula is encoded such that a value is divided by another in the form of a variable it is imperative that the divisor variable cannot be set to zero. Should it be so then the program will crash with a "Division by Zero Error." The solution to this problem is straightforward. Whenever a variable is to be used as a divisor then either a conditional statement should check that it is a non-zero value or a logical statement should pull it up to a safe non-zero value.

Finally, in relation to formulae, is the need to ensure that a calculation, or series of calculations, does not take the result to a number which is too large or too small for the computer to handle. The maximum and minimum numbers which a particular computer can handle are usually readily found in the manufacturer's handbook. The solution to the problem is to carry out approximation calculations using the extreme values that the program allows (ie. round the calculation to values of 10 to see if the result ends up with, say, more than 38 noughts!)

Precision

The first feature of precision that creates errors is the apparent precision of the computer. Most computers will deliver the results of a simple calculation in the form of a 9 figure display if other than a low order whole number. That the number shown may not be absolutely correct is not readily appreciated. As the computer carries out its calculations in binary arithmetic various compromises have to be made to bring the number back into the decimal system of our everyday world. These compromises can result in the last digit being wrong.

The majority of the time the error will be so insignificant that it can be readily ignored. However, unless the programmer is aware of this source of possible error then the trivial error may become a major stumbling block. As when the result of a calculation is multiplied by a significantly large number, or the result is used in a logical comparison for equality.

The answer is first to be aware of the problem and, second, to limit the use of, or not use at all, the computer's apparent precision. When in the real world, the problem is solved using numbers to the decimal places then bringing the results of any computer calculation back to two decimal places at each stage in the calculation. By trailing six or seven decimal place numbers through a series of calculations any errors gain a cumulative effect, ie. they get bigger! When making logical comparisons, compare for greater or lesser values instead of comparing for equality.

For serious mathematical work most applications will require the use of Floating Point arithmetic, ie. real numbers with a decimal content if required. The modern microcomputer therefore has Floating Point arithmetic built-in. However, some processes do not have non-whole numbers in the real world. Coach parties, for instance, are usually made up of a whole number of people! Where whole numbers are the order of the day then use integer functions and variables. Serious errors can be introduced by using the wrong number type.

Last but not least in the area of numeric errors is the question of not treating fractions as a special case. Once again, as the computer works in binary arithmetic peculiarities can arise with fractions that do not fit the binary mould exactly. The fractions that do, the good old imperial ½, ¼, ⅛, 1/16, etc. do not hold any particular problems.

It is the non-binary fractions that cause problems. Not only might they pick up numeric inaccuracy in the primary conversion from a fraction to a binary number but they are prone to pick up relatively high order inaccuracy as they cross the whole number boundary during calculations. One divided by 3 and then multiplied by 3 on a computer may not always give the answer of One! The solution is to be aware of the limitation and determine how your particular version of BASIC handles fractions in the range and combination expected in the program.

ALPHABETIC

Errors in this family also fall into two general groups! The first group relates to the construction and use of strings, whilst the second group relates to the slicing of strings.

Construction

The ease with which strings can be concatenated (added together) within a program can readily produce a string which is too long, eg. the Commodore computers limit the length of a string to 255 characters. When a string goes over the limit an error is flagged. The remedy is to keep strict control of string usage. Only concatenate strings if it is central to the object of the coding. Very often simply linking strings with semicolons within the same printing operation (to screen, printer, tape or disk) is quite sufficient. Encode checks on sub-string lengths prior to concatenation if the string data being handled is not under the direct control of the programmer.

During the construction of strings it is quite a common error to gain or loose spaces. Commodore BASIC gathers up the space allocated for the sign of a number when that number is converted to a string using the STR$< function; a "spare" space is to be found at the start of the number. Where this space is an embarrassment then it can be removed by string slicing.

Embedding spaces is quite easily achieved when entering DATA statements. Subsequent READing of the DATA will carry over the extra space, particularly where the string text data has not been enclosed in quotation marks. Generally, these rogue spaces only spoil the screen display or printed output, are easily observed and equally quickly corrected. However, when the string in question is subject to manipulation, the extra or missing character can create quite interesting errors!

Remember, the space is a character and has a value (32) which is recognised and acted upon by the computer just like any other in its character set. When manipulating strings be sure that the strings are as you intended them to be. Carefully proof read any DATA and encode to validate any input, especially from the keyboard.

To overcome the need to predefine the length of every string, as is characteristic of many of the other high level languages, machines running BASIC generally store any string declared in a program at a suitable location in memory with an entry in a pointer table as to its whereabouts.

When a string is first declared in the listing the pointer points to the string's location in the block where the BASIC program is. Any subsequent redeclaration of the string variable results in the characters of the new string being stored in the first free space available, in Commodore machines at the top of RAM, with the entry in the pointer table amended accordingly.

With frequent redeclaration the free RAM becomes cluttered with stored strings for which the amended pointer table holds no pointers. These strings are mere rubbish to the computer. When the time comes that no free RAM is left in which to put a fresh string the computer sets about tidying up its string storage. All the strings for which no pointer exists will be discarded, and the strings to be retained will be reorganised from the top of memory such that there is no wasted space.

This operation is known as "garbage collection." During garbage collection the computer appears to hang up or go dead for what can seem a long time even to the experienced user. It is this dead time that may give rise to the catastrophic actions of the naive user. Faced with an apparently dead computer they start prodding the keyboard. They may stop the program, leaving disk or tape files open and jeopardise the work entered to that time. They may simply switch the machine off with consequent loss of data and possible corruption of stored data.

The solution is straightforward. Monitor the redeclaration rate of strings and force garbage collection when it suits you. If there is a danger of garbage collection having to take place, make sure it occurs when you can accept it (or at least warn the user of its occurrence), rather than allowing it to occur at the whim of the computer's operating system.

The embedding of control characters in strings is a condition fraught with errors. The purpose of these control characters in Commodore BASIC cover the variety of screen display commands. In many instances the specifying of these characters requires a combination of keys to be pressed. Often the resultant symbol is either virtually unintelligible or is extremely common place. In such instances the selection of the wrong control character may go unnoticed. One solution is to declare the control character(s) as a unique string variable and then to link them within coding, eg. CS$=CHR$(147):PRINT CS$; "Further text".

Try to avoid concatenating the control character string with a regular text string or the scope for error is reawakened.

Slicing

Firstly, when slicing strings, it is important to incorporate checks to ensure that the slice is valid. These checks should take a similar form to those for keyboard or data file input. However, the simplest solution is the exercising of great care when constructing and then testing the program to ensure that the slice is that which you want, under all circumstances. The padding of strings subject to concatenation is one way of ensuring the same relative position of data to be subsequently extracted by slicing. The embedding of markers in strings for positive location of the start (and end) of a slice is another.

One sure way of obtaining an invalid slice is to use the wrong mode of slicing! The choice of which mode of string slicing is most suitable for a given requirement is entirely in the hands of the programmer.However, where the programmer has not thoroughly understood the modes of string slicing available on his machine then the error of using the wrong mode is most likely to occur, and to go unnoticed! The only solution is to know your BASIC; to know your LEFT$ from your RIGHT$!

Not uncommon is the error of slicing the wrong string. The use of counting loops may pick-up the wrong position in an array, or step through it by the wrong increment. A calculated value used as an array subscript may not give the expected value and, therefore, the expected string. It is up to the programmer to check the functioning of a string slicing routine, by use of considered dummy strings, before the routine is fully incorporated in the main program.

The last, but not least, of the slicing errors is the slicing of a null string. To try and slice a string that does not exist gives the computer apoplexy. It is most likely to cause a program crash with an error message along the lines of, "invalid string!" Null strings can creep into programs from quite unexpected sources. A (RETURN) in answer to an INPUT prompt without any input may result in a null string. The careless coding of a GET$ may result in a null string. An extra comma in a DATA list may result in a null string. And so on!

The simple way to keep this error in check is to place a conditional statement before the slicing operation to ensure that the string to be sliced is not a null string.

A general note on string slicing is in order. The manipulation of strings is a major feature of BASIC. It has to be said that many of the errors in string handling are caused by programmer carelessness and ignorance. The declaration, construction, storage and manipulation of strings must be practiced with great care. The programmer must ensure that he understands the manner in which his machine handles strings. Which leads us nicely into the next section!

CODING

And once again the errors in this family fall into two general groups! The first group relates to the meaning of the code employed, its semantics. Whilst the second group relates to the effects of running erroneous code, its execution.

Semantics

Choosing the wrong BASIC function is the most fundamental error in this group. Whilst the choice may be syntactically correct, and therefore will not cause the program to crash, the result of the use of the wrong choice may not be as intended. The most common area for such mistaken choices is in the area of handling external devices. Often the function chosen is both quite legal and intended for the general area of operation for which it has been encoded. However, the problem arises because its scope of operation is either too broad or too narrow.

For example, most disk operating systems have the ability to transfer data as single characters or as whole strings. When the program is required to handle data stored as strings, the getting of single characters from those strings only to rebuild them to the same strings is often pointless and most certainly error prone.

The solution is to avoid complexity whenever possible. Complex coding may look clever but, unless it is serving a real purpose, its presence may merely point to the programmers inability to define a problem! When a section of coding starts to become quite complex that is the time to review the problem and the method of its solution.

After all is said and done, the coding is only a small part of the overall activity of programming. One shouldn't jeopardise the other areas of programming merely to display one's dexterity with the BASIC language or in the manipulation of the computer's operating system:

In a similar vein is the choice of the wrong Boolean logic operator. Choosing AND instead of OR, or vice versa, can create quite different results than those intended. All sections of logic coding should be thoroughly tested in isolation from the main program. Only when proven to be functioning as intended should they be embedded in the main program.

The use of confusing or conflicting variable names can generate hard to detect errors. By maintaining a careful record of the variables used, and for what purpose, it is a practical proposition to identify the possible source of such errors and nip their propagation in the bud. Moreover, the record is the only sure way to avoid using a given variable name twice; easy to do in a large or complex program but often quite difficult to recognise. By keeping to the same variable names for commonly used self-enclosed routines inadvertent corruption of the routines central to the program is avoided.

Using, for example, "D" as the variable in FOR/NEXT loop used to produce a delay in a program. Thereafter, avoid using "D" as a variable in anything other than a delay count.

When choosing variable names the choice of one that relates to its purpose lessens the chances of it contributing to the growth of errors both at the time of writing and during subsequent updates of the program.

The effective maning of a block of code can be changed by the manner in which the code is constructed. Besides the mathematical considerations of comparisons and the choice of the right logical operators, there is the very real consideration of the positive or negative feel to a piece of coding. The more steps that a program has to go through to achieve an object then the more opportunities that arise for an error.

When checking data a positive approach is to check whether the data is in the most commonly supplied or expected form. Only after excluding the majority case should the code start to look for the lesser order variants.

A negative approach would be to check for the exclusions first and then work up through the lesser order acceptable data until arriving at the most common variant. Often the nature of the data dictates the order of selection. Control characters, for example, usually have to be screened out first before any concatenation of data. With positive code a condition is clearly defined and the program flow dictated by its presence. A negative approach excludes the known disasters and accepts the remainder.

In such circumstances an enterprising user may well deliver an error souce, even if unintentionally! A positive approach is generally a lot less effort as it is usually easier to define what a condition may be than to cover all the things that it isn't.

Execution

The real scope for commissioning errors in your program is the area of program execution. A suitably sloppy programming style can create opportunities for errors undreamt of by Beelzebub's most ardent supporter! The classic has to be jumping into (or out of) subroutines and FOR/NEXT loops. The subtle variant is to do so only when a particularly rare condition is met. Such an error can go undiscovered for several test runs of the program. It merely loads the stack with useless addresses which the stack quietly accepts until it is full. At which time it will crash the program with an out of memory message. (Try 100 GOSUB 100 to see the effect of filling the stack.)

Less catastrophic, but none the less error prone, is indiscriminate jumping about a program. Jumps within a program should be kept to a minimum. A sound programming style will promote an ordered arrangement to a program. The simplest form of order is the block structure.

The safest way of jumping about a program is to have two levels of jumps. Those that are within a block and those between blocks. Within blocks the jumps can be fairly indiscriminate, so long as they are necessary and correct (jumping to the wrong place in a program is an error of carelessness on the programmer's part). Jumps between blocks however should always enter or emanate from a given block at the one chosen point in each case. Where necessary jump within a block to the exit point before jumping to another block.

During the execution of a program,should a variable be allowed to assume uncontrolled value then all sorts of errors may obtain. Incrementing a variable as a count which, in turn, is used to subscript an array can lead to lost or hidden data and to a crashed program. Where the construction of the program uses such sontrol variables then checks on their legality in relation tot he rest of the program and to the computer's operating system should be made.

Similar problems arise with calculated control variables or subscripts. The result of a calculation may not point to the array element required because of the imprecision mentioned earlier. The same imprecision can cause the program to sit in a loop because the conditional statement depending upon a calculted result is not met. In both instances this form of error requires that the programmer investigates thoroughly the manner in which the computer on which he is working carries out the various calculations he has chosen to use in his code.

The manner in which an operating system increments a FOR/NEXT loop variable can result in the well known off-by-one error. Such as when one less or one more data item than was intended is accessed, or an array element adjacent to the one intended is accessed. Remember that the result of the calculation used as an array subscript will be treated as an integer, ie. A(9/2) will give A(4). The same error can result in incomplete data transfer to a storage medium, or the attempt to recover more data than was stored. For data transfer always use an End of Data marker, eg. "EOD" or -1.

When manipulating strings and numeric data it is quite easy to be drawn into the situation where the distinction between the two types of data becomes blurred. The direct comparison of a string with a number will bring the inevitable syntax error crashing down about your ears. However, having taken care to ensure full flexibility of manipulation by enstringing the numbers, the number strings can be legally compared with normal character strings. The results may not be as expected. The solution is to ensure that the data subject to comparison, besides being of the same type, is sensible.

However much as one tries to avoid doing so in the name of good programming it is inevitable that at some time a programmer will have to PEEK or POKE about in his machines memory. At the very least he will be forced to make a system call. These activities can cause beautiful, one shot, show stoppers! Getting the location wrong can lock the machine solid. The off switch being the only thing that will function. Alternatively, calling the wrong location may create quite devious little errors which are totally inscrutable. When it is necessary to go below the level of the BASIC language then be sure that what you are doing, besides being essential, is right. Errors hidden in machine code outside the main BASIC program are awkward to fathom and difficult to correct.

```
100 REM ------------------------------
110 REM  METEOR STORM  BY D C BOWDREY
120 REM
130 REM  A DEMONSTRATION PROGRAM OF
140 REM
150 REM  THE USE OF BOOLEAN LOGIC TO
160 REM
170 REM  CONDENSE STANDARD BASIC.
180 REM ------------------------------
190 REM
200 REM  SETTING UP
210 POKE53280,0:POKE53281,0:REM TOTAL BLACK SCREEN IE. REAL SPACE
220 S$=CHR$(5):C$=CHR$(153)
230 REM
240 REM CENTRE OF TOP LINE
250 P=1044 : REM FOR C64
260 REM  P=32788 FOR PETS
270 REM 4 IN FROM TOP LEFT
280 E=1028 : REM FOR C64
290 REM  E=32772 FOR PETS
300 REM 4 IN FROM TOP RIGHT
310 W=1060 : REM FOR C64
320 REM  W=32804 FOR PETS
330 REM KEYBOARD BUFFER
340 K=631 : REM FOR C64
350 REM K=623 FOR PETS
360 REM KEYBOARD QUEUE
370 Q=198 : REM FOR C64
380 REM Q=158 FOR PETS
390 L=52: REM ASCII LEFT MOVE KEY
400 R=54: REM ASCII RIGHT MOVE KEY
410 S=32: REM SPACE CHARACTER
420 C=22: REM CRAFT CHARACTER
430 Z=0 : REM ZERO VALUE
440 P$="█████████████████████████"
450 REM P$ = HOME + 24 CURSOR DOWNS
460 REM IE. POSITION ON BOTTOM LINE
470 A$(0)=".":A$(1)="*"
480 REM
490 REM ------------------------------
500 REM  THE PROGRAM - METEOR STORM
510 REM ------------------------------
520 REM
530 PRINT"█"C$:REM CLEAR SCREEN
540 PRINTTAB(14)"██METEOR STORM"
550 PRINTTAB(14)"─────────────"
560 PRINT:PRINT
570 PRINT"<4> TO STEER TO STARBOARD"
580 PRINT:PRINTTAB(11)"<5> TO HOLD COURSE"
590 PRINT:PRINTTAB(20)"<6> TO STEER TO PORT"
600 PRINTP$TAB(11)"PRESS <5> TO START";
610 GETA$:IFA$<>"5"THEN GOTO 610
620 PRINT"█":REM CLEAR SCREEN
630 REM
640 REM ------------------------------
650 REM 2 LINE LOGIC BLOCK STARTS HERE
660 REM
670 REM THE OBJECT OF THE DEMONSTRATION
680 REM ------------------------------
690 REM
700 P=P+((PEEK(K)=LORP>W)-(PEEK(K)=RORP<E)):POKEP,C:T=T+1
710 PRINTS$P$TAB(RND(1)*38+1)A$(RND(1)+.2)C$:POKEQ,Z:ON(-(PEEK(P)
    =S))GOTO700
720 REM
730 REM ------------------------------
740 REM ------------------------------
750 REM
760 H=H-((T-H)*(T>H)):PRINTCHR$(147)"SCORE:"T"HIGH:"H:POKEK,32
770 PRINTP$TAB(10)"PRESS <5> TO RESTART";
780 POKEQ,Z:ON(-(PEEK(K)<>53))GOTO780:P=1044:T=0:GOTO620:REM
    P=32788 FOR PETS
READY.
```

Splitting screens

Pete Gerrard offers advice on how to split a screen into any shape or size and, to make things more interesting, poses a little puzzle for you to solve. As an added incentive we are giving away a free Ibico printer for the best solution

Although this section of the magazine is called 'Hints and Tips'. you mustn't get the mistaken impression that all the information conveyed here is only going in one direction. In other words, this month's collection of ideas are intended to help you, but also to set you a little bit of a problem as well. Hence the title of the article: 'Splitting Screens: A Jigsaw Puzzle'. We'll give you all the pieces of program needed to write a routine that splits a screen in any shape or form that you might care to name. The only problem is that you have to fit all the pieces together!

Before we start out on our quest, a small diversion. Consider the following listing.

```
LISTING ONE:SIMPLE COMMAND ADDER
10 FORI=0TO143:READA:POKE49152+I.A:NEXT
20 PRINT"DATA NOW IN PLACE."
30 REM SYS49152,A,B,C:A=BORDER.B=BACKGROUND.C=INK
30000 REM BLOCK # 0
30001 DATA32,253,174,32,235,183,132.91
30002 DATA133.92,160,1,165,20,133,88
30003 DATA165,21,133,89,134,90,142,1
30004 DATA193,165,88,141,0,193,136,208
30005 DATA248,169,176,24,101,89,133,89
30006 DATA201,191,144,3,76,72,178,169
30007 DATA0,133,87,165,90,164,87,162
30008 DATA0,164,91,165,92,32,241,183
30009 DATA164,87,134,90,165,90,153,2
30010 REM BLOCK # 1
30011 DATA193,230,87,234,234,234,234,234
30012 DATA165.87,201,1,208,221,173,0
30013 DATA193,141,32,208,173,1,193,141
30014 DATA33,208,173,2,193,141,134,2
30015 DATA96,0,0,0,0,0,0,0
30016 DATA0,0,0,0,0,0,0,0
30017 DATA0,0,0,0,0,0,0,0
30018 DATA0,0,0,0,0,0,0,0
30019 DATA0,0,0,0,0,0,0,0

READY.
```

A Simple Command Adder

One hundred and forty four bytes of data are read in and POKEd into the memory area starting at $C000 hexadecimal, or 49152 in decimal. A most useful 4K block of spare space on the 64: You'll notice that the last 39 bytes are simply zeros, a by-product of the program used to turn a machine code program into a block of data statements.

Line 30 tells you what the program does. Run it, and then by typing:
SYS 49152,A,B,C
where A=border colour (0 to 15)
B=background colour (0 to 15)
and C=ink colour (0 to 15)
you can quickly change the appearance of the screen. If you're changing colours a lot within a program, this might save you a reasonable amount of memory. To see how it's working, it would be easier to look at it with an assembler of some sort, and then you'll see that the program will only accept three parameters A,B and C, and that these parameters are then stored into the appropriate memory locations. It should be a fairly easy matter to alter this program to do all kinds of different things, as we've seen in other issues of this magazine.

Back to splitting screens

But enough of this diversion, let's get back to splitting screens, starting with a look at the techniques involved.

The main thing that concerns us here is the raster register, held in two consecutive memory locations, namely (53248+18) and the high bit of location (53248+17). We can store an interrupt value in these locations, and, basically, ask the 64 to advise us when that value has been reached. Thus, if we store a value of, say, 194 there, we can tell the 64 that when it reaches the 194th raster, stop everything, go to our own routine, and then get back to normal again.

Our own routine might split the screen into two different colour areas, have one area of text and one area of graphics, or whatever. The point to note is that merely by altering these two locations, we can determine where and when things will happen.

Unfortunately, life is not quite as straightforward as that. The timer interrupt, which looks after the cursor, TI$, cassette motors and various other things, runs at a rate of about sixty times a second. The screen or raster interrupt also runs at about this rate, and every now and again the two will appear to coincide. That is, when we want to change the appearance of the screen because we're at the 194th raster, the timer interrupt will already have started, and things will just have to wait. The effect of this is to cause a noticeable screen jitter.

How to get round this? Shut the timer interrupt off, and only call it after we've finished with the raster interrupt. The following program does the trick, giving us a split colour screen, with the bottom seven lines being reserved for one colour and the top eighteen for another.

```
BORDER PROG 1

90 POKE 53265.27
100 FORJ=52480TO52516:READX
110 T=T+X:POKEJ.X
120 NEXTJ
130 REM 162.194:CHANGE 194 FOR NEW BORDER POSITION
131 REM 160.0:CHANGE 0 FOR NEW COLOUR
132 REM AND  160.7:CHANGE 7 FOR NEW COLOUR AT BOTT
OM
200 DATA 169.1,141,25,208,162,194,160,0,173,18,208
,16,4,162,1
210 DATA 160.7,142,18,208,140,33,208,173,13,220
220 DATA 41,1,240,3,76,49,234,76,188,254
300 POKE56333,127
310 POKE 788,00:POKE789,205
320 POKE53274,129

READY.
```

Lines 130 to 132 tell you what to alter to change the colours and the point at which the screen splits.Just one note of caution. Don't attempt to use the cassette deck after running this program: do a RUN-STOP/RESTORE first.

You want text and graphics instead? Okay, try this slightly different program.

```
TEXT AND GRAPHICS SPLIT SCREEN

90 POKE 53265,27
100 FORJ=49152TO49188:READX
110 T=T+X:POKEJ,X
120 NEXTJ
130 POKE 53281,9:POKE53280,7:PRINT"[BLK]A LITTLE B
IT OF TEXT"
200 DATA 169,1,141,25,208,162,194,160,21,173,18,20
8,16,4,162,1
210 DATA 160,23,142;18,208,140,24,208,173,13,220
220 DATA 41,1,240,3,76,49,234,76,188,254
300 POKE56333,127
310 POKE 788,00:POKE789,192
320 POKE53274,129
READY.
```

Only a few, very few, minor differences to note. In the first program we were storing colours in the appropriate memory location for changing the screen colour (53281, or $D021 in hexadecimal), whereas in this one we're storing the values 21 and 23 (or $15 and $17 in hexadecimal) into location 53272 ($D018 in hexadecimal). You may know already the commands:

POKE 53272,21 for graphics
POKE 53272,23 for text

Well, this program is doing it for you. The last few POKE Commands in each case are turning off the timer interrupt, setting the IRQ vector to point to our new code and not to go to where it usually does, and finally switching on the raster interrupt.

As usual, you'd be well advised to study this listing with an assembler if you want to see exactly how it's working. Otherwise, just use it.

Problems, problems

Okay, we've seen two parts of the jigsaw so far. We can split a screen anywhere we like, either into two different coloured areas, or into two separate text and graphics areas. However, you'll note that if you run the programs and then list them, everything just overlaps. In other words, there's no way of stopping when you reach the eighteenth line of the screen, or wherever, and going back to the top of the screen again, or just scrolling up the top eighteen lines and leaving the bottom seven where they are. As in The Hobbit, for example.

The next program is a bit of a cheat, but is a step in the right direction.

```
SPLIT SCREEN IN BASIC ?!

10 FORI=0TO71:READA:POKE49152+I,A:NEXT
20 SYS49152:POKE53281,7:POKE53280,9
30 REM NO. 5 DETERMINES COLOUR OF TOP PART OF SCRE
EN
31 REM THUS, CHANGE ALL REFERENCES TO 5 TO
32 REM SOMETHING ELSE FOR DIFFERENT COLOUR
30000 REM BLOCK #1
30001 DATA 160,0,169,5,153,0,216,169
30002 DATA160,153,0,4,200,192,240,208
30003 DATA 241,160,0,169,5,153,240,216
30004 DATA 169,160,153,240,4,200,192,240
30005 DATA 208,241,160,0,169,5,153,224
30006 DATA 217,169,160,153,224,5,200,192
30007 DATA 240,208,241,160,0,169,119,153
30008 DATA 208,6,169,0,153,208,218,200
30009 DATA 192,40,208,241,96,0,0,0
```

All this does is to colour in the top lines of the screen, and leave the bottom ones as they were, by putting in shifted spaces everywhere and drawing a line at the bottom of the newly coloured-in area.

Lines 30 to 32 tell you how to change the colour to be whatever you like.

Now, by forgetting our first two programs, we can approach the problem from a different tack. Here we have a program that will fill in the top two-thirds of the screen in one colour, and leave the bottom third untouched. How do we now tell when the cursor has reached the bottom of the top part of the screen (I'm getting myself confused here!), in order that we can update the top part, but leave the bottom part unchanged?

```
CHECKING FOR POSITION ON SCREEN
B*
   PC  SR AC XR YR SP
.;5491 33 00 79 00 F6
.
CF00 AD F0 CF      LDA $CFF0
CF03 C9 01         CMP #$01
CF05 F0 03         BEQ $CF0A
CF07 4C 31 EA      JMP $EA31
CF0A 20 10 CF      JSR $CF10
CF0D 4C 31 EA      JMP $EA31
CF10 A5 D6         LDA $D6
CF12 C9 10         CMP #$10
CF14 10 06         BPL $CF1C
CF16 C9 11         CMP #$11
CF18 F0 02         BEQ $CF1C
CF1A 60            RTS
CF1B EA            NOP
CF1C A9 93         LDA #$93
CF1E 20 D2 FF      JSR $FFD2
CF21 20 3F C3      JSR $C33F
CF24 A0 00         LDY #$00
CF26 A9 A0         LDA #$A0
CF28 99 F8 06      STA $06F8,Y
CF2B A9 07         LDA #$07
CF2D 99 F8 DA      STA $DAF8,Y
CF30 C8            INY
CF31 C0 28         CPY #$28
CF33 D0 F1         BNE $CF26
CF35 60            RTS
CF36 03            ???
.
.
B27D 86 71         STX $71
.?
.?
.?
```

Sorry to dive into machine code, but it does make the explanation easier. First of all, we look at location $CFF0, or decimal 53282, to see what value it contains. If it contains a one, we're going to check on the position of the cursor. If it doesn't, we're not, and so jump to the internal interrupt ROM routine at $EA31. You'll need to set locations 788 and 789 to point to $00 and $CF respectively in order to use this routine.

Okay, we're going to check on the position of the cursor, so jump to the subroutine at location $CF10. Load the accumulator with the content of location $D6, or 214 in decimal, which tells us where the cursor lives on the screen.

If this is 16 or 17, then we want to jump to the routine at location $CF1C, which performs a clear home, jumps to a routine at $C33F, draws a line of yellow shifted spaces underneath our split area to give the impression that nothing's changed, and finally returns.

The routine at $C33F? This is the fourth listing we gave you transferred to another area of memory, so if you want you can change 20 3F C3 at location $CF21 onwards to read 20 00 C0 if you wish, to achieve a little bit of compatability.

Fancy a scroll?

This works, but is a little untidy. Wouldn't it be nicer to just scroll up the top seventeen lines, rather than clearing the whole thing? Of course it would, which means that we need a routine to scroll the screen.

As ever, there's no point in re-inventing the wheel, so here's Commodore's own ROM routine for scrolling the whole screen one line upwards at a time.

```
ROM SCROLL ROUTINE
B*
   PC  SR AC XR YR SP
.;8FEB 33 00 D3 00 F6
.
E8EA A5 AC          LDA $AC
E8EC 48             PHA
E8ED A5 AD          LDA $AD
E8EF 48             PHA
E8F0 A5 AE          LDA $AE
E8F2 48             PHA
E8F3 A5 AF          LDA $AF
E8F5 48             PHA
E8F6 A2 FF          LDX #$FF
E8F8 C6 D6          DEC $D6
E8FA C6 C9          DEC $C9
E8FC CE A5 02       DEC $02A5
E8FF E8             INX
E900 20 F0 E9       JSR $E9F0
E903 E0 18          CPX #$18
E905 B0 0C          BCS $E913
E907 BD F1 EC       LDA $ECF1,X
E90A 85 AC          STA $AC
E90C B5 DA          LDA $DA,X
E90E 20 C8 E9       JSR $E9C8
E911 30 EC          BMI $E8FF
E913 20 FF E9       JSR $E9FF
E916 A2 00          LDX #$00
E918 B5 D9          LDA $D9,X
E91A 29 7F          AND #$7F
E91C B4 DA          LDY $DA,X
E91E 10 02          BPL $E922
E920 09 80          ORA #$80
E922 95 D9          STA $D9,X
E924 E8             INX
```

```
E925 E0 18      CPX #$18
E927 D0 EF      BNE $E918
E929 A5 F1      LDA $F1
E92B 09 80      ORA #$80
E92D 85 F1      STA $F1
E92F A5 D9      LDA $D9
E931 10 C3      BPL $E8F6
E933 E6 D6      INC $D6
E935 EE A5 02   INC $02A5
E938 A9 7F      LDA #$7F
E93A 8D 00 DC   STA $DC00
E93D AD 01 DC   LDA $DC01
E940 C9 FB      CMP #$FB
E942 08         PHP
E943 A9 7F      LDA #$7F
E945 8D 00 DC   STA $DC00
E948 28         PLP
E949 D0 0B      BNE $E956
```

```
E94B A0 00      LDY #$00
E94D EA         NOP
E94E CA         DEX
E94F D0 FC      BNE $E94D
E951 88         DEY
E952 D0 F9      BNE $E94D
E954 84 C6      STY $C6
E956 A6 D6      LDX $D6
E958 68         PLA
E959 85 AF      STA $AF
E95B 68         PLA
E95C 85 AE      STA $AE
E95E 68         PLA
E95F 85 AD      STA $AD
E961 68         PLA
E962 85 AC      STA $AC
E964 60         RTS
E965 A6 D6      LDX $D6
```

Look out for the CPX #$18, at locations $E903 and $E925. Changing the 18 to an 11 means that only the top seventeen lines will be scrolled. Exactly what we want!

Copy this routine into RAM rather than leaving it in ROM, so that we can alter it, and change those eighteens to elevens.

Finale

That's the final part of our jigsaw. Put all the pieces together and you have a universal plit screen routine.

Have fun, and dabble with the routines. Make changes and see what happens. Only by doing that will you be able to truly understand what's happening. And the best of British luck!

How to win the Ibico printer

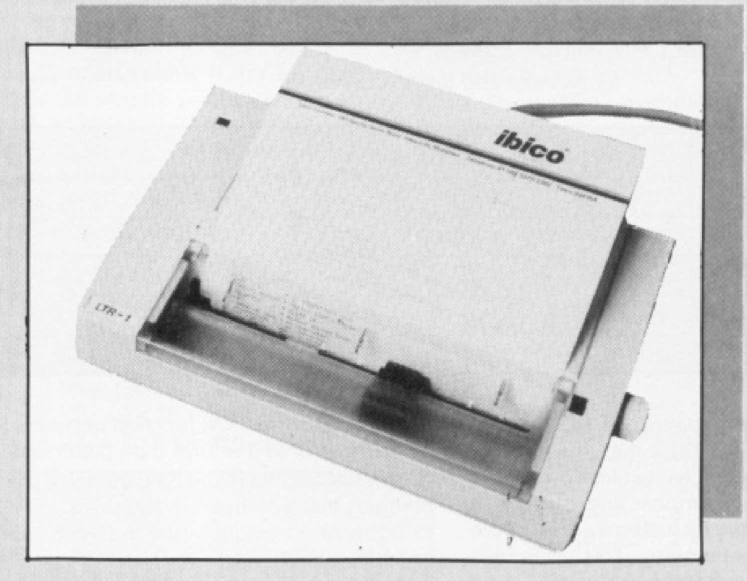
In the above article Pete Gerrard has given you all the pieces of program needed to write a routine that splits a screen in any shape or form.

Your task is to put all the pieces of this jigsaw together. The sender of the most elegant solution to the problem will receive Ibico's LTR 1 letter-quality printer, favourably reviewed in CCI's December issue.

Entries should be submitted on tape or disk, accompanied with listings is possible, to:

Jigsaw Puzzle,
Commodore Computing International,
Finsbury Business Centre,
40 Bowling Green Lane,
London EC1R 0NE.

Entries will be judged by the author, Pete Gerrard, and should arrive at CCI no later than March 10.



Ibico's LTR-1 is compatible with the 64 through a serial or parallel interface

Exclusive-or routine

If you've always steered away from Machine Code thinking it too hard, think again! Mike Hart points out one significant exception, Exclusive-or routines

Programmers who are new to 6502 machine code generally find that what is easy to do in BASIC is generally more difficult to do in machine code. However, there is one significant exception and this is the 'exclusive-or' routine which is much easier to perform in machine code than in BASIC.

Operation of 'exclusive-or'

The 'exclusive-or' function works by comparing the bit patterns of two numbers and then returning a '1' for every case where the bit patterns are dissimilar. In other words, if the relevant bits show two '1's or two '0's then a zero will be returned, but a bit pattern of a 1 and a 0 or a 0 and 1 will return a 1. This is best illustrated by a diagram:

Figure 1

Bit patterns and the 'exclusive-or'

	128	64	32	16	8	4	2	1	Comments
(a)	1	0	1	1	0	1	1	0	182 = $B6
(b)	0	1	0	0	1	0	0	1	73 = $49
(c)	1	1	1	1	1	1	1	1	182 EOR 73 = 255
(d)	0	1	0	0	1	0	0	1	73 = $49
(e)	1	0	1	1	0	1	1	0	255 EOR 73 = 182

Line (a) is the bit pattern of 182 decimal ($B6) whereas line (b) is the bit pattern of 73 decimal ($49). If we exclusive-or these two numbers we compose line (c) in which a '1' appears if the bit patterns are NOT the same or a '0' otherwise. This gives us a number the bit patterns of which are 1 1 1 1 1 1 1 1 which is 255 decimal (=$FF). Now for the interesting stage! If we take our newly created number and exclusive -or with the second number we find that the first number reappears! Line (d) is the repeat of line (b) and performing another exclusive-or returns our original number ie. line (e)=line(a)!

At this stage, it should be clear how an 'exclusive-or' can be useful to use. If we 'exclusive-or' every byte with one particular number, or even better a particular sequence of numbers then we can 'encode' our program whilst an exclusive-or with the same sequence of numbers will restore the original bytes.

Machine code 'exclusive-or' and a BASIC 'exclusive-or'

In machine code, an exclusive-or is performed very simply by the EOR instruction. In BASIC, the process is more complicated because the normal OR function performs an *in*clusive-or ie it returns a bit pattern of '1' if either *or both* of the bit patterns of the numbers being compared contains a '1'. So to perform an exclusive-or in BASIC we need to.

- — first compute an 'inclusive-or'
- — then find those bits which contain a '1' in both numbers ie the bits that are 'included' in an 'inclusive-or' but 'excluded' in an 'exclusive-or'. (By now, the terminology should start to make some sense.)
- — Subtract the 'common' bits from the inclusive-or figure which should then give us an 'exclusive-or' figure.

In order to illustrate this process in machine code and in BASIC I have taken two other numbers and will show how the BASIC code can perform, in a rather long-winded way, what is so straightforward in machine code. In BASIC, the coding for an 'exclusive-or' is:

(A ORB) AND NOT (A AND B)

If we take the last part of the expression first, then (A AND B) identifies all of those bits that are both a '1': anything else will be a '0'. NOT (A AND B) takes the pattern that we have just created and turns all the '1's into a '0' and all of the '0's into a '1' ie it 'flips' the bit pattern. Now all of the 'common' bits will be presented by a '0' and every other bit by a '1'. If we now AND this number (the NOT (A AND B)) with the 'inclusive-or' then every bit which is *not* a 'common' bit will be included in the new number but the 'common bits' will be 'masked out' by the NOT (A AND B). Hence we end up with an 'exclusive-or!

This process may be very hard to visualise without a diagram so Figure 2 takes the two numbers of 179 and 98 and shows how the machine code and BASIC versions of exclusive-or give you the same answer in the end. The machine code routine will do it in a minute fraction of the time taken by the BASIC routine needless to say.

Notes: Lines (a)-(c) perform the machine code exclusive-or as in Figure 1.
Lines (d)-(f) compute a BASIC *in*clusive-or (first part of expression)
Lines (g)-(j) compute a NOT (A

Figure 2

Machine code and BASIC versions of 'exclusive-or'

	128	64	32	16	8	4	2	1	Comments
(a)	1	0	1	1	0	0	1	1	179 = $B3
(b)	0	1	1	0	0	0	1	0	98 = $62
(c)	1	1	0	1	0	0	0	1	179 EOR 98 = 209
(d)	1	0	1	1	0	0	1	1	179 = $B3
(e)	0	1	1	0	0	0	1	0	98 = $62
(f)	1	1	1	1	0	0	1	1	179 OR 98 = 243
(g)	1	0	1	1	0	0	1	1	179 = $B3
(h)	0	1	1	0	0	0	1	0	98 = $62
(i)	0	0	1	0	0	0	1	0	179 AND 98 = 34
(j)	1	1	0	1	1	1	0	1	NOT (179 AND 98)
(k)	1	1	1	1	0	0	1	1	179 OR 98
(l)	1	1	0	1	1	1	0	1	NOT (179 AND 98)
(m)	1	1	0	1	0	0	0	1	(179 OR 98) AND NOT (179 AND 98)

AND B) (second part of expression) Lines (k)-(m) ANDS the second part of the expression with the first part to create a BASIC exclusive-or. Note that line (m) is the same as line (c).

Now that the theory has been explained, it is possible to put the routine to a practical use. The example to be illustrated shows how it is possible to store machine code in a REM statement at the very start of a BASIC program and in this position it will be automatically saved along with the rest of the program and can be used to 'code' or to 'decode' any program that is in memory. Incidentally, this procedure is a useful one that can be applied to other small machine code routines but with one restriction ie they must not contain the 0 byte as otherwise the BASIC interpreter will interpret it as the end of a line and this will play havoc with the rest of the program.

The program has been developed on a CBM C-64 but can be easily adapted for the other CBM machines. Either type in the whole of the listing as shown or, with an existing program already in memory, type in lines 1-10. it is important that you have *exactly* 65 asterisks in the REM statement in line 1 and also that you include the quote marks immediately after the REM. Do not leave a space between the SYS and the 2061. lines 3-10 contain the machine code data which is fed into the space provided by the asterisks in Line 1. You can check that you have the code in the correct place by ensuring that PEEK (2127) gives you a zero both before and after loading the code. After the code is loaded you may delete lines 2-10 if you wish as their function has now been served.

If you type SYS 2061 then your program will look decidedly peculiar after listing as the bytes in the program are EOR-ed with a sequence of numbers (randomly generated in the range 0-255) Typing SYS2061:LIST will restore the program to health for you. It may be that your cursor on the C-64 seems to disappear because some of the bytes have changed the foreground colour to the same as the background colour. If this happens, then clear the screen, select white foreground with a CTRL 2 and then type SYS2061:LIST and all will reappear. The machine code in line 1 will look very peculiar as the data is interpreted as graphics characters but do not worry about this.

To adapt the program for a VIC it is necessary to change one byte as the BASIC text in the VIC varies according to the amount of memory. Take the 6th byte in the data list (which is an 8) and change it to:

16 Unexpanded VIC
4 VIC with 3K expansion
18 VIC with 8+K expansion

For all PET's change this byte from an 8 to a 4. Also change the SYS call in line 1 to SYS 1037 and the locations in line 2 to 1037 (in place of 2061) and 1101 (in place of 2125). The checksum in line 2 should be 6751.

To enhance the safety of your programs, you may save the program in a coded state but it will RUN normally on loading. If you like, you may include POKE's to ensure that the program cannot be stopped or SAVE'd — eg.

	Disable	*Reenable*
C64 RUN/STOP + RESTORE	POKE 808,225	POKE 808,237
VIC RUN/STOP + RESTORE	POKE 808,100	POKE 808,112
C64 SAVE	POKE 818,32	POKE 818,237
VIC SAVE	POKE 802,0:POKE 803,0	POKE 802,243: POKE 803,243

Disassembly

A disassembly is provided for those who would like to see how the machine code works. The high order byte of the line number of the *second* line is fed into text pointers. These are used to fetch a byte of text and EOR it if it is not a zero or the same as the existing byte in 'STORE' (location $02). If it is a zero, then the byte from the text signals the end of a line so a further test is done to see if the end of the program has been reached. If it is, then the program exits but if not, five is added to the text pointers to ensure that the end-of-line zero byte and the four link bytes and line number bytes are avoided.

This precaution is taken because when the program is saved and then RUN, the link pointers are 're-established' and if this is done with 'corrupted' bytes then the repeated EOR will not be able to restore them.

If the byte fetched from the text is the same as the EOR byte in STORE ($02) then the EOR operation is not performed. This is because a number EOR-ed with itself generates a zero and this would be interpreted as an end-of-line byte with dire consequences. Notice that no zero bytes are included in the machine code given to set in the REM statement in Line 1 for similar reasons. This also explains why the pointers are loaded with the location *one before* the start of the text in the second line and the first text byte fetched with a LDA ($22), Y when Y = 1 rather than the more usual Y = 0.

The routine is completely relocatable as there are no calls to ROM or subroutines called from within the text. The two bytes sitting at the end of the disassembly are to ensure that the listing displays a white foreground in upper case when the second call to SYS2061 restores the program to proper health.

EOR in BASIC

To achieve a similar effect in BASIC try the following in direct mode (with some abbreviations to get it to fit on one line):

```
FORJ=2121TOPEEK(46)*256:J=
J-5*(PEEK(J)=0):X=PEEK(J):
POKEJ,(XOR1)ANDNOT(XAND1):
NEXT [C64version]
```

A 15.3K program takes 0.5 seconds to EOR in machine code but 347 seconds to do the same in BASIC ie. machine code is about 700 times faster! If nothing else, this is a dramatic illustration of the speed of the latter.

```
1 SYS2061:REM"*****************************************************************"
2 FORJ=2061TO2125:READX:T=T+X:POKEJ,X:NEXT:IFT<>6755THENPRINT"DATA ERROR!":STOP
3 DATA 169,83,133,34,169,8,133,35
4 DATA 133,2,165,2,10,10,56,101
5 DATA 2,133,2,160,1,177,34,240
6 DATA 16,197,2,240,4,69,2,145
7 DATA 34,230,34,208,229,230,35,208
8 DATA 225,200,177,34,200,17,34,240
9 DATA 13,24,169,5,101,34,133,34
10 DATA 144,208,230,35,176,204,96,5,142
100 :
110 REM EOR/DEMO
120 :
130 REM BY MIKE HART
140 :
150 FOR J=1 TO 20
160 PRINT J,J*J,SQR(J)
170 NEXT
180 PRINT:PRINT"--END OF DEMO--":END
190 :
200 REM LINE 1 SHOULD BE :
210 REM SYS2061:REM"...65 ASTERISKS..."
220 REM RUN2 TO LOAD MACHINE CODE!
230 :
240 REM PEEK(2127) SHOULD BE 0 BOTH
250 REM BEFORE AND AFTER FILLING
260 REM LINE 1 REM WITH MACHINE CODE.
270 :
280 :
290 REM TYPE 2061:LIST TO ENCODE
300 REM AND JUST THE SAME TO DECODE
310 :
320 REM DO NOT WORRY IF THE CURSOR
330 REM SEEMS TO DISAPPEAR AFTER A LIST
340 REM OF THE ENCODED PROGRAM
350 :
360 REM JUST CLEAR THE SCREEN,SELECT
370 REM WHITE WITH A <CTRL 2> AND
380 REM TYPE 'SYS2061:LIST <RETURN>'
390 REM TO RESTORE THE PROGRAM
400 :
410 REM GOOD LUCK!
420 :
READY.
```

```
B*SSEMBLY   EOR/RAN/DEMO
.;0008 B0 A2 A2 03 F6
.
080D A9 53      LDA #$53
080F 85 22      STA $22
0811 A9 08      LDA #$08
0813 85 23      STA $23
0815 85 02      STA $02
0817 A5 02      LDA $02
0819 0A         ASL
081A 0A         ASL
081B 38         SEC
081C 65 02      ADC $02
081E 85 02      STA $02
0820 A0 01      LDY #$01
0822 B1 22      LDA ($22),Y
0824 F0 10      BEQ $0836
0826 C5 02      CMP $02
0828 F0 04      BEQ $082E
082A 45 02      EOR $02
082C 91 22      STA ($22),Y
082E E6 22      INC $22
0830 D0 E5      BNE $0817
0832 E6 23      INC $23
0834 D0 E1      BNE $0817
0836 C8         INY
0837 B1 22      LDA ($22),Y
0839 C8         INY
083A 11 22      ORA ($22),Y
083C F0 0D      BEQ $084B
083E 18         CLC
083F A9 05      LDA #$05
0841 65 22      ADC $22
0843 85 22      STA $22
0845 90 D0      BCC $0817
0847 E6 23      INC $23
0849 B0 CC      BCS $0817
084B 60         RTS
084C 05 8E      ORA $8E
```

An extended example Length/TP

Whoops! Last month we omitted this listing from our Machine Code article entitled 'Machine Code movements' — Sorry!

```
LENGTH/TP DISASSEMBLY

033C A9 00          LDA #$00
033E 85 02          STA $02
0340 AD BC E0       LDA $E0BC
0343 A2 72          LDX #$72
0345 C9 20          CMP #$20
0347 F0 17          BEQ $0360
0349 A2 7A          LDX #$7A
034B C9 0B          CMP #$0B
034D F0 11          BEQ $0360
034F A2 82          LDX #$82
0351 C9 8B          CMP #$8B
0353 F0 07          BEQ $035C
0355 A2 8A          LDX #$8A
0357 C9 E3          CMP #$E3
0359 F0 01          BEQ $035C
035B 60             RTS
035C A9 03          LDA #$03
035E 85 02          STA $02
0360 86 58          STX $58
0362 A9 03          LDA #$03
0364 85 59          STA $59
0366 A0 07          LDY #$07
0368 B1 58          LDA ($58),Y
036A 99 8A 03       STA $038A,Y
036D 88             DEY
036E 10 F8          BPL $0368
0370 30 20          BMI $0392
0372 20 83 CF       JSR $CF83
0375 60             RTS
0376 20 1D BB       JSR $BB1D
0379 60             RTS
037A 20 D9 DC       JSR $DCD9
037D 60             RTS
037E 20 1C CA       JSR $CA1C
0381 60             RTS
0382 20 CD DD       JSR $DDCD
0385 60             RTS
0386 20 1E CB       JSR $CB1E
0389 60             RTS
038A 20 CD BD       JSR $BDCD
038D 60             RTS
038E 20 1E AB       JSR $AB1E
0391 60             RTS
0392 A6 02          LDX $02
0394 B5 29          LDA $29,X
0396 85 52          STA $52
0398 A9 00          LDA #$00
039A 85 51          STA $51
039C A9 02          LDA #$02
039E 85 53          STA $53
03A0 A9 00          LDA #$00
03A2 85 54          STA $54
03A4 A0 00          LDY #$00
03A6 B1 51          LDA ($51),Y
03A8 F0 0E          BEQ $03B8
03AA E6 53          INC $53
03AC D0 02          BNE $03B0
03AE E6 54          INC $54
03B0 E6 51          INC $51
03B2 D0 F0          BNE $03A4
03B4 E6 52          INC $52
03B6 D0 EC          BNE $03A4
03B8 C8             INY
03B9 B1 51          LDA ($51),Y
03BB C8             INY
03BC 11 51          ORA ($51),Y
03BE D0 EA          BNE $03AA
03C0 A6 53          LDX $53
03C2 A5 54          LDA $54
03C4 20 8A 03       JSR $038A
03C7 A9 CF          LDA #$CF
03C9 A0 03          LDY #$03
03CB 20 8E 03       JSR $038E
03CE 60             RTS
03CF 20 42 59       BYTES Sp B  Y
03D2 54             BYTE  T
03D3 45 53          BYTES E  S
03D5 0D 00 20       BYTE CR,0
```

```
1 REM ****   LENGTH/TP   ****
2 :
3 REM   **  M. C. HART   **
4 :
5 FOR J=828 TO 982:READ X:POKEJ,X:NEXT
6 :
10 DATA 169,0,133,2,173,188,224,162
11 DATA 114,201,32,240,23,162,122,201
12 DATA 11,240,17,162,130,201,139,240
13 DATA 7,162,138,201,227,240,1,96
14 DATA 169,3,133,2,134,88,169,3
15 DATA 133,89,160,7,177,88,153,138
16 DATA 3,136,16,248,48,32,32,131
17 DATA 207,96,32,29,187,96,32,217
18 DATA 220,96,32,28,202,96,32,205
19 DATA 221,96,32,30,203,96,32,205
20 DATA 189,96,32,30,171,96,166,2
21 DATA 181,41,133,82,169,0,133,81
22 DATA 169,2,133,83,169,0,133,84
23 DATA 160,0,177,81,240,14,230,83
24 DATA 208,2,230,84,230,81,208,240
25 DATA 230,82,208,236,200,177,81,200
26 DATA 17,81,208,234,166,83,165,84
27 DATA 32,138,3,169,207,160,3,32,142
28 DATA 3,96,32,66,89,84,69,83,13,0
READY.
```

ACCESS BY SYS 828

Dear Editor...

Dear Editor

Could you please help me! For a while now I have been learning 6502 machine code on my Commodore 64 and creating small games. But then I came to a snitch. What I was after was a machine code routine to produce a random number between 1 and 100, but I just cannot figure it out. Can you help me?

Gary Watts
Weymouth
Dorset

There are some memory locations on the 64 which constantly change. By reading these, it's possible to create a pseudo random number. An example would be:

```
GLOOP   LDA $D012
        BEQ GLOOP
GLOOP1  SEL
        SBC #100
        BEQ GLOOP2
        BCS GLOOP1
GLOOP2  ADC #100
        CMP #100
        BEQ GLOOP
        RTS
```

This takes the value from the raster scan register and if 0, it is read again. The value 1-255 is then scaled down to 1-100 by the SBC and ADC commands. The numbers are fairly random but slightly weighted towards values 1-55.

Dear Editor

What happened with the 'Basic Aid'?

In the first issue vol.3, in the section on machine code, you promised the reader a completed version, with the key words and some other features.

In the second issue vol.3 you published a lister, which could be included in 'Basic Aid'. Unfortunately, it does not work together with the auto line number routine. (At least with me it doesn't, but maybe there is a mistake in my typing.)

I hope you will go on with 'Basic Aid' soon. I would also like to see an article on compilers (Basic and others).

I will be very glad if you could answer these questions.

A J Van Nieuwenhuyzen
Rotterdam
Holland

It is true that auto and list scroller are not compatible. There has been a hole up with the final version of the 'Basic Aid'. We will be publishing it in its entirety as soon as possible.

Dear Editor

Could you please put me right over the problems I am experiencing with my two Commodore cassette units for the Commodore 64. One is an old style Datasette (the type associated with PETS), the other being the more recent C2N cassette unit.

Some programs I have for the 64 will only load on one and not the other, namely Ant Attack, Decathlon and Chuckie Egg will only load on the Datasette. Once more, the old Datasette sends the 64 into total confusion if the 1541 is connected to the back but not necessarily with power on. There are two questions I would like to ask, namely:

1. Why will some programs load on the Datasette only, and
2. Why will the Datasette not work with the 1541 connected?

Please can you help?!

P Jackson
North Bradford
W Yorks

Unfortunately, there must be something wrong with the cassette unit that does not work with your 1541. We contacted Commodore's technical department, which says that both units were made to the same specifications; the only changes were cosmetic. If the unit is still under warranty, return it to your dealer. If not, ring Commodore information in Corby on 0536 205252.

Dear Editor

I would like to find a good word processing program for the VIC 20. Can you help me?

John Warren Jr
Minnesota
USA

Two word processors at opposite ends of the price range are available from the VicSoft department at Commodore. One is Wordcraft 20 on cartridge for £70 and the other is VicWriter on disk or cassette for £9.99 — opposites indeed. It depends on what you want. To order or ask questions, contact VicSoft, Commodore, 1 Hunters Lane, Weldon, Corby, N Hants NN17 1QX. Tel: 0536 205252. Pay by check or postal order.

Dear Editor

As a hard and fast reader of your mag since issue one, I look back on the good old days when I could pick up my mag and know that if I flicked through the pages there would be something about the VIC 20. Is it that you have changed the name of the mag to Commodore 64 and not told the publisher?

Let's have some consideration for the good old VIC 20. We are still there you know.

M J Whyvell
Wheatley
Doncaster
S Yorkshire

CCI has no intention of abandoning the loyal VIC 20 following as long as you don't. Witness — the December 1984 issue, Vol 3 No 6.

Dear Editor

Having recently bought the Zeus 64 assembler from Crystal, I am unable to get it to operate with my CBM 1520 printer plotter. I was wondering if you would throw any light on the subject as this tends to restrict what is otherwise an excellent assembler.

When I attempt to print anything I get a 'File not open' error upon investigation of the print routine at $C799-$C7AB. I changed the device number before the SETLFS kernel routine to 6 which returns the same error. On further investigation I can find no evidence of the OPEN routine.

Any advice on this subject would be welcome.

A Ramsdale
Scunthorpe
S Humberside

First check if the assembler has an option to input information about a printer that is different from the standard it accepts. If not, the assembler may not be designed to work with a plotter at all. The 'File not open' message means you are using a wrong or conflicting device number, though the one you are using ordinarily would be correct. If you have questions, consult someone in hardware at Commodore's information service 0536 205252. Otherwise, the author of this month's assembler feature, Kevin Bergin, says he would be happy to try to help. His number is 01-722 8324.

Do you have a problem? If you have a technical query or advice to other readers, drop us a line at:

QUERIES,

Commodore Computing International,
Finsbury Business Centre,
40 Bowling Green Lane,
London EC1.

Learn the lingo

Pete Gerrard continues to unravel the mysteries of computer terminology

CP/M
The language that Confuses People Most, it is a common operating system that can be transferred to all computers using a Z80 processor. It is a trademark of Digital Research.

CPU
Central Processing Unit, the heart and brain of the computer that controls everything that goes on.

CRASH
What happens to a computer when it refuses to operate any more.

CRT
Cathode Ray Tube. The display part of a television, monitor or video terminal.

CURSOR
A flashing sq2uare or bar on the computer screen that shows where the next character entered will be displayed.

DATA
Information of any type.

DATA BASE
A program that organises, stores and cross references collections of data.

DATA BUS
Channel for passing information.

DATA FILE
Collection of data.

DEBUG
Locating and eliminating (hopefully!) programming errors.

DECAY
The rate at which a musical note falls from its peak volume.

DEFAULT
The value assigned to a variable by a program when not specified by the user.

DIAGNOSTIC ROUTINE
Self testing program used by computer to find hardware and (occasionally) software problems.

DIGITAL
A method of measurement that uses precise quantities to represent values.

DISK
A device that looks like a conventional record on which large amounts of data can be stored and accessed rapidly. They can be single or double sided, and single or double density, which altogether allows up to four times the information to be stored on one disk.

DOCUMENTATION
Usually intended to guide the person using a computer, it frequently achieves the opposite.

DOS
Disk Operating System, or an operating system written specifically for disk drives. Sometimes used to refer to a program to make life easier for people using disk drives.

DOT MATRIX
Using printed dots in an array to represent letters.

ELECTRONIC SPREADSHEET
Piece of software that manipulates interrelated mathematical values at great speed.

EXECUTE
To run a program, and obey the instructions contained therein.

EXTERNAL STORAGE
Storing data on a peripheral device such as a cassette or disk.

FILE
A collection of data that is inter-related in some way. Usually refers to files of data as stored on disk or cassette.

FINANCIAL FORECASTING
Generic term covering software that attempts to project finance management into the future.

FLOPPY DISK
One of the most commonly used storage media, looking like a flexible single record.

FLOW CHART
Used as an aid to program development, it is a collection of various shaped boxes connected by a series of lines to show the sequence of operations in (usually) a computer program.

FORMAT
To prepare a disk for use.

FORTRAN
Computer language mainly used in scientific or mathematical applications. Stands for FORmula TRANslation.

FRICTION FEED
Paper fed into a printer in the same way that it is usually fed into a typewriter i.e. one sheet at a time.

GIGO
Garbage In, Garbage Out. Putting mistakes into a program will only make mistakes come out.

GRAPHICS
Any non-alphanumeric display produced by a computer.

HARD COPY
To produce output on a printer.

HARD DISK
As opposed to floppy, these are capable of storing much more information.

HARDWARE
Which should really be called computer hardware. Collection of physical devices (literally hard) that make up a computer system.

HIGH LEVEL LANGUAGE
A language that is easier for us to understand than it is for the computer to understand, like BASIC, PASCAL, or FORTRAN.

IEEE-488
One of the three standard interfaces.

INCREMENT
A value which increases the value of a variable. Opposite of decrement, which decreases the value.

INPUT
The art of getting data or information into a computer or its peripherals.

INTEGER
A whole number, regardless of whether it's positive, negative or indeed equal to zero.

INTERACTIVE
Allowing the user to constantly communicate with the computer during operation.

INTERFACE
A device that allows two computers, or a computer and a peripheral, to communicate with each other. Can be either electronic or physical. See serial and parallel.

INTERNATIONAL SOCIETY OF ELECTRICAL ENGINEERS' LAWS
If it's fragile, you'll drop it. If it's reasonably robust, you'll fall on it. The most obvious way of connecting things up is the one that will result in the most damage. Only irreplaceable parts break.

JARGON

INTERPRETER
A computer program that translates the program typed in a high level language (like BASIC) into a program in low level language that the computer can readily understand. The program is executed as it is interpreted, unlike a compiler, which merely translates the program but doesn't run it.

I/O
Input/Output. Refers to devices, as well as the art of putting information intoand getting it out of computers, disk drives, etc.

JOYSTICK
A peripheral device mainly used for games or graphics.

KEYBOARD
Typewriter in the form of a terminal, used to enter information into the computer.

KILOBYTE
The unit of measurement of memory size in computers. One K is equal to 1024 bytes.

LANGUAGE
A set of conventions for telling a computer what to do.

LETTER QUALITY PRINTER
One that produces output that closely resembles that of a good typewriter.

LINE
A horizontal sequence of letters. Also, a line is a part of a computer program.

LISTING
A printout, either on the screen or a printer, of the lines of instructions that go to make up a program.

LOAD
Transferring a collection of information into the computer.

LOGO
Computer language that primarily uses English-like commands. Designed mainly for schoolchildren, it also features Turtle graphics.

LOOP
What computers frequently get into and then can't get out of.

LOW LEVEL LANGUAGE
One which is more intelligible to the computer than it is to most of us humans. Like, for instance, Assembler.

MACHINE CODE
Instructions as sent to the computer in the language that it can understand directly.

MAGNETIC STORAGE
Usually refers to tape or disk storage, where information can be filed and recalled for later use. It can be destroyed by magnetic or electrical interference.

MAINFRAME
Extremely large computer.

MEGABYTE
One million bytes.

MEMORY
A feature lacking in a number of humans, computers nevertheless have a lot of it. RAM, ROM, BUFFER, all have their own definitions, but memory usually refers to the circuits in a computer that store information which is directly accessible to the computer, as opposed to that which requires some kind of interface to access it.

MEMORY LOCATION
One specific area in the computer.

MEMORY MAP
A diagram of all the memory locations that can be accessed by the computer.

MENU
A list of program options which the user must choose from.

MICROCOMPUTER
Go on, hazard a wild guess.

MICROPROCESSOR
A very complex integrated circuit that can be programmed to perform a variety of tasks.

MOB See **SPRITE**

MODE
A set of conditions under which specific rules apply.

MODEM
An electronic device that allows computers to communicate via the telephone network.

MONITOR
A high resolution cathode ray tube, capable of producing a very clear and exceptionally high quality display.

MOUSE
An electronic cursor, which is operated by movement in a specific direction, rather than using a set of different cursor keys.

NETWORK
Connecting a number of computers to one main computer. Usually the main computer controls the disk drive and printer of the set up.

OPERATING SYSTEM
The internal software that controls the computer and allows it to function.

OUTPUT
Information sent by the computer to any peripheral device, including the screen.

PARALLEL
Transmission of data where all the parts of a word are handled at the same time, eight bits at a time.

PASCAL
Computer language, similar to BASIC but much more structured.

PEEK
BASIC command that allows you to look at the contents of a specified memory location.

PERIPHERAL
Any equipment that can be connected up to a computer.

PILOT
A programming language designed mainly for educational question/answer sessions.

PIXEL
The smallest programmable graphics element on the screen. The more pixels a computer can display, the higher the screen's resolution.

POLTTER
A printer with a microprocessor inside, designed for plotting graphics rather than letters.

POKE
Opposite of PEEK, a command which lets you alter the contents of specified memory locations.

PORT
Refers to a socket on the computer which can be used to attach external devices.

PRINTER
A peripheral designed to produce hard copy of computer output.

PROGRAM
Set of instructions given to the computer to perform a given series of tasks.

PROGRAMMING LANGUAGE
Just that, a language that you can program in, including BASIC, FORTRAN, PASCAL etc.

PROMPT
A symbol or phrase that requests input from the user.

QUEUE
A sequence of programs waiting to be run by the comptuer.

RAM
Random Access Memory, memory inside the computer that can be altered by the user. Any alterations are lost when the power is turned off. Sometimes called Volatile memory.

RAMtop
Top of computer memory.

RANDOM ACCESS
The retrieval of a portion of information that does not require a sequential search through a file.

RECORD
A collection of related data elements. A group of records constitutes a file.

RESOLUTION
Basically, the clarity of the display on your television or monitor.

RESPONSE TIME
The amount of time it takes a computer or peripheral to respond to a given instruction.

ROM
Read Only Memory, which cannot be altered by the user, and whose contents are not lost on power down. Typically, it contains information required by the computer, e.g. that which provides BASIC.

RS-232
Another industry standard interface.

SCROLL
After the screen is filled with data, the top line of data disappears to make way for another line of data appearing at the bottom. Software techniques enable scrolling to take place in all four directions (up, down, left, right).

SEARCHING
The act of looking for a specific piece of data. This can take a very long time.

SECURITY
Protection of hardware and software, to prevent unauthorised copying.

SERIAL
Transmission of data one bit at a time.

SOFTWARE
Computer programs: the programs that instruct the computer how to operate.

SPEECH SYNTHESIS
Software and hardware that converts digital information into sounds that can sometimes sound like Kenneth Kendal, and occasionally like human speech.

SPRITE
A high resolution graphics character designed by the user. Sometimes called a MOB.

STACK
An area of computer memory used to store information temporarily.

STORAGE
The art of saving data in the computer or on a peripheral.

STRING
A sequence of alphanumeric characters, usually arranged in a specific order.

SUBROUTINE
A portion of a program, usually used more than once, that performs a specific sub-task within the main program.

SYNTAX
The rules that govern exactly how an instruction must be written.

SYSTEM
Mechanical and electronic operation that allows input, processing and output of information.

TAPE
Usually a magnetic cassette for storing information from a computer.

TERMINAL
A peripheral that consists of a keyboard, videoscreen or paperprinter, and a means of connecting it all up to a computer.

THERMAL PRINTER
Paper printer that uses heat sensitive, and therefore expensive, paper.

TIME SHARING
As employed by staff on British Rail stations, a method that allows two or more users to do the same thing (usually using a computer) simultaneously.

TRACTOR FEED
Printer that uses continuous stationery.

USER PORT
Connection on most computers that can send or receive signals under the control of the user.

USER GROUP
Collection of users, and an organisation that is well worth joining.

VARIABLE
Name given to a value that varies during the course of running a program.

WARM START
Restoring the operation of a computer without switching it off.

WINCHESTER
Just one example of a technology used in the manufacture of disk drives, that is employed by a number of manufacturers.

WORD PROCESSING
Using a computer to produce documents, standard letters, etc.

WORK SPACE
Usually something that there is never enough of.

Z80
The name of one of the more common CPUs.

Superbase 96

THE COMPLETE INFORMATION STORAGE AND CONTROL SYSTEM. SUPERBASE 96 TRANSFORMS COMMODORE MODEL 8096 OR 8296 INTO A FULL-FEATURED, PROFESSIONAL DATABASE SYSTEM! WITH UP TO 1100 CHARACTERS PER RECORD ON UP TO 4 SCREENS... AND UP TO 128 ITEMS PER RECORD, DEFINABLE AS KEY, TEXT, NUMERIC, CONSTANT, RESULT OR DATE... IN FILES OF UP TO 16M CHARACTERS! WITH SPREADSHEET AND CALCULATOR CAPABILITY, CALENDAR FUNCTIONS, MULTIPLE CRITERIA SORT AND SEARCH, EASY INPUT FROM WORDPROCESSOR/DATA FILES, BOTH MENU-DRIVEN AND PROGRAM OPTIONS, BATCH AND TRANSACTION PROCESSING, FULLY DEFINABLE OUTPUTS... SUPERBASE 96 IS ESSENTIAL IF YOU WANT THE MOST FROM YOUR COMMODORE! SUPPLIED ON 8050/8250 DISK, WITH EXCELLENT TUTORIAL/REFERENCE MANUAL. OUR PRICE ~~£454.25~~ £375.00!

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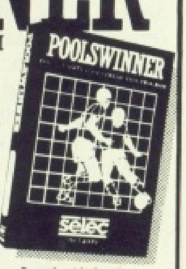
POOLSWINNER

THE ULTIMATE POOLS PREDICTION PROGRAM



Boxed, with detailed instruction booklet

- **MASSIVE DATABASE** Poolswinner is a sophisticated Pools prediction aid. It comes complete with the largest database available – 22000 matches over 10 years. The database updates automatically as results come in.
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- **SUCCESSFUL** SELEC guarantee that Poolswinner performs significantly better than chance.
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- **SIMPLE DATA ENTRY** All English and Scottish team names are in the program. Simply type in the reference numbers from the screen. Or use FIXGEN to produce fixture list automatically (see below).
- **DISC/MICRODRIVE COMPATIBLE** All versions (except Apple and IBM) are supplied on tape, with simple instructions for conversion to disc/microdrive operation.

(This seasons results are supplied with the package so that predictions can start immediately.)

AVAILABLE FOR Spectrum (48K), Commodore 64, VIC 20 (+16K), AMSTRAD CPC 464, BBC B, Atari (48K), ZX81 (16K), Dragon, Apple II, IBM pc

PRICE £15.00 (all inclusive)

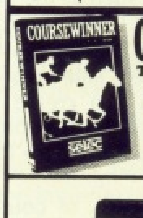
NEW

FIXGEN 84/5

AT LAST: No more struggling for hours to get the fixture list into the computer. FIXGEN has been programmed with all English and Scottish fixtures for 1984/5. Simply type in the date, and the full fixture list is generated in seconds. Fully compatible with Poolswinner.

POOLSWINNER with FIXGEN £16.50 (all inclusive)

Fixgen alone £5.50



COURSEWINNER V3

THE PUNTERS COMPUTER PROGRAM

Coursewinner is designed to allow you to develop and test your own unique winning system. Using information from daily newspapers or 'Sporting Life', the most important factors can be input and analysed. The program is supplied with a database detailing best trainers and jockeys, and effect of the draw for all British courses. (Flat & National Hunt.)

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Sound sensations – first impressions

EXCLUSIVE

CCI's first impressions of Siel's CMK 49, the first computer keyboard capable of interfacing directly with the 64. Next month a more in-depth review will be provided by a band heavily involved in synthesised music

EXCLUSIVE

Our first impressions of Siel's CMK-49 are definitely favourable. For the price — just £125 — you are getting the facilities of a synthesiser which would probably cost around £800. Due to the limited amount of time we had to experiment with this package, it would not be fair to voice our final opinions. So this month we are sharing our first impressions and will follow this with a more extensive review next month by a professional band.

The CMK 49 is a complete package which exploits the musical possibilities of the 64's SID chip. It comprises a 49-note keyboard, a specific interface (eliminating clumsy wiring) and software which is available on both disk and cassette.

Assuming you already own a 64 (or the SX-64), the only additional hardware required is a cassette unit or disk drive and a TV or monitor.

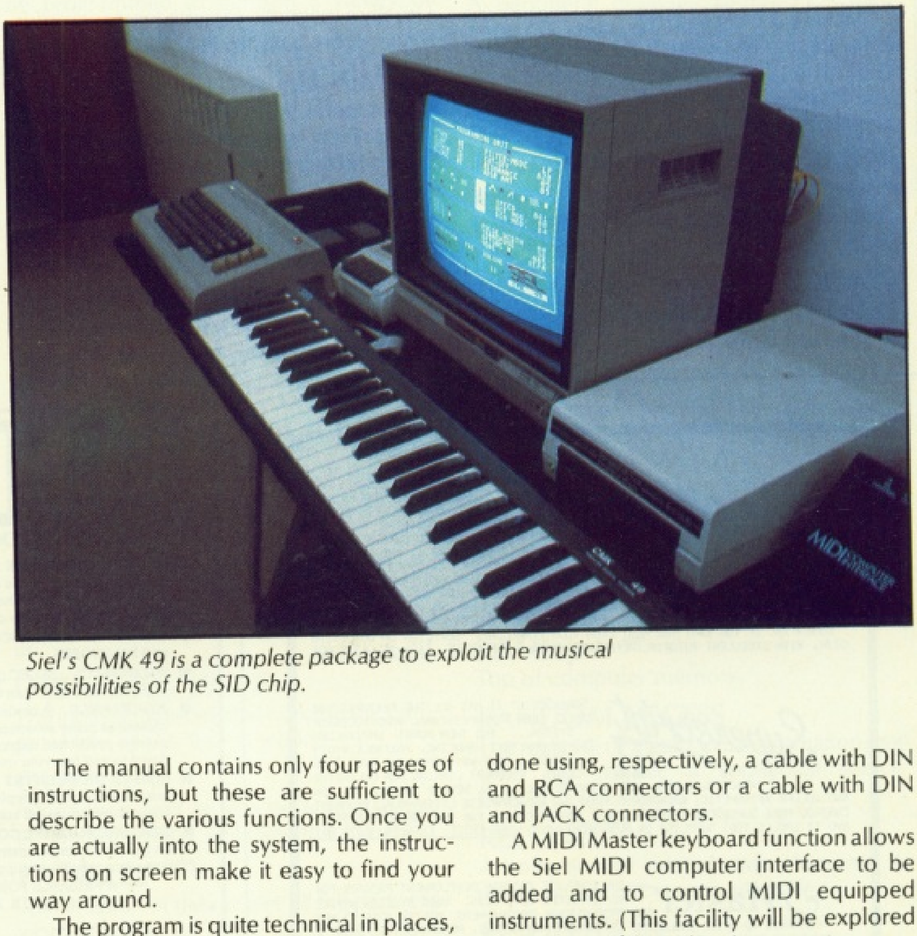
The keyboard interfaces directly into the computer's cartridge port. It uses the SID chip for all music synthesis and allows 99 monophonic or polyphonic sounds to be created and then stored on disk or cassette.

It is the loading process which produced our only real gripe. Our review sample was cassette-based. The time taken to load the software is around 20 minutes. However, it is not particularly the length of time that concerned us, but the fact that the screen remains blank throughout this loading time. The manual does not quote the loading time and people could easily misinterpret this visual silence as meaning that the program is not loading.

We have passed this gripe onto Siel and so there is the possibility that they will now include some sort of reassuring message to assure you that the program is loading.

Once loaded the main menu appears showing the main options of the system. These are:

1 EDIT PLAY
2 POLYPHONIC NEW SOUND
3 MONOPHONIC NEW SOUND
4 MIDI MASTER KEYBOARD
5 DISK/TAPE OPERATION
6 END OF JOB



Siel's CMK 49 is a complete package to exploit the musical possibilities of the SID chip.

The manual contains only four pages of instructions, but these are sufficient to describe the various functions. Once you are actually into the system, the instructions on screen make it easy to find your way around.

The program is quite technical in places, but just by trial and error even the most musically ignorant should be able to produce interesting results.

There are 39 presets ranging from instruments such as the piano or banjo through to UFO and explosion. Most of these sounds are instantly recognisable — others require a little imagination!

You can create new polyphonic and monophonic timbres, a process which takes place in the Programming unit section.

You can, of course, stick with the TV speakers but you get a far superior and more realistic sound if you link up with a hi-fi system or external amplifier. This can be done using, respectively, a cable with DIN and RCA connectors or a cable with DIN and JACK connectors.

A MIDI Master keyboard function allows the Siel MIDI computer interface to be added and to control MIDI equipped instruments. (This facility will be explored in next month's review.)

If you find that the top end of the keyboard produces louder sounds than the bottom end, don't think that you're going deaf in one ear. The SID chip has no facility for filter tracking, whereas most keyboards incorporate a tracking control which boosts the frequency of the lower notes.

For the price, Siel's CMK 49 is a very interesting package. Anyone with a 64 and musical inclinations will find it both productive and fun.

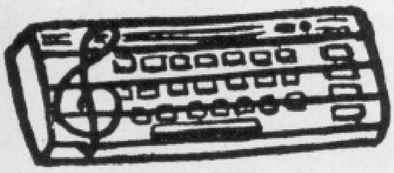
Contact: Siel (UK) Ltd, AHED Depot, Reigate Road, Hookwood, Horley, Surrey RH6 0AY. Tel: 02934 76153/4.

"Lost in Music"

Wanna buy a music package? Read on before you do. It takes time to learn properly and could cost up to £45.00 ... Pop musician John Rafael explores three musical packages for the 64

Woody Allen once said "I learnt to type the 'Allen Method': Qwertyuiop;Asdfghjkl and Zxcvbnm — but the trouble is these words rarely come up in normal letter writing."

With the New Year musical novice in mind we looked at three music packages for the 64 — Musicalc 1 — Synthesiser and Sequencer, the Commodore Music Maker and Ultisynth 64, and examined how effective and educational they were.



MUSICALC 1 SYNTHESISER AND SEQUENCER

At £45.00 the most expensive of all the packages we looked at but a very well thought out and presented disk software program. Musicalc 1 is the heart of the Musicalc "family" which incorporates Musicalc 2 Scorewriter, for the composer and Musicalc 3 keyboard maker, to customise the 64's keyboard to play your own scales. So it's a system that will grow with you as you become more proficient.

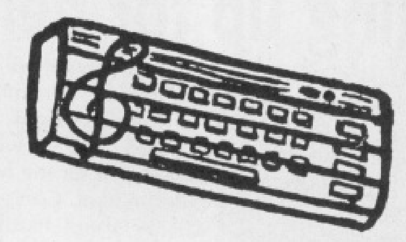
The owner's manual is well set out and holds your hand through the early stages with a "quick start up" page and instructions on which keys to press to get Musicalc up and working quickly; to give you an idea of what it's and your capabilities are. It explains the basic concepts and exactly what a synthesiser and sequencer are.

It then gives you a *Sequencer Tutorial*, getting you to enter music and a *Synthesiser Tutorial*, making you change sounds. SBoth are a bit like painting by numbers, giving you a finished result without really explaining how and then going into more detail having stimulated your enthusiasm and curiosity.

The display panel is divided into two sections: the left hand side showing the current state of the synthesiser and the right hand side shows you a moving display of the music sequence in memory.

All in all, we found the Musicalc 1 a very good package and highly enjoyable, taking a lot of mysticism away from the world of electronic music but it won't turn you into a Thomeson Twin overnight.

Contact: Musicalc UK, The Metropolitan, Enfield Road, London N1 5AZ. Tel: 01-241 2448.



COMMODORE MUSIC MAKER

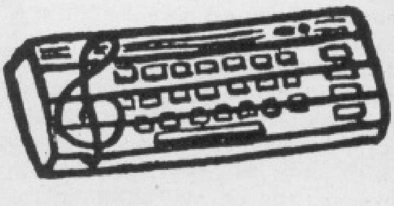
Commodore turns the 64 into a musical instrument via a disk and a clip-on mechanical keyboard (£29.95) which is designed to depress mechanically the Qwerty keys in a piano simulation. It is an interesting idea which gives the computer a recognisable face but unfortunately isn't very sturdy — our keyboard was a bit bent and had to be stuck down with masking tape! The package also contains little stickers to put on the plastic keys so that one recognises each note and "Start Playing Keyboard" the SFX tutor manual.

The book seems to be designed with quite a young pupil in mind unless you happen to like "Michael Row The Boat Ashore" still, one has to start somewhere I suppose. The software has eight built-in voices which simulate instruments such as the clarinet, piano and synthesiser and can be altered to create virtually any sound within the capability of the Commodore 64; there isn't any substitute for the real instrument though.

Various other functions are available — rhythm combinations, tempo, bass — line and poly play enabling you to play three note chords. Enter a tune note by note and then enter the timing by tapping any key in the appropriate rhythm. It will then playback the complete tune in perfect timing. The piano keys are also duplicated on the screen and light up when the corresponding note is played.

An interestingly presented package suitable for the younger computer musician and reasonably priced.

Contact: Commodore, 1 Hunters Lane, Weldon, Corby, N. Hants. Tel: 0536 205555.



ULTISYNTH 64

This is the only cassette — based package of the three and took three attempts to actually load. Not a very exciting package and rather complicated for the beginner. The manual is just a little larger than the cassette and though comprehensively indexed does not really provide very much light for an inexperienced user.

The menu comprises of RECORD; PLAYBACK; LOAD; SAVE; COMPOSE; TRANSFER NOTES AND PRETAB — few easily digestable. It is easy to get lost inside the various modes if you don't know the manual inside out and though pressing the space bar should get you back to the main menu, this isn't always the case.

The screen is divided into three — the top half containing the famous ADSR (attack, decay, sustain and release) values and the waveform selected for each voice; the bottom half is divided into two which contains horizontal barcharts showing the frequency of each voice, filter frequency; resonance etc... One controls these via up to 154 key combinations. There are also six preset accompaniments and one can save compositions on disk or cassette.

Certainly not an easy program to get ones teeth into and even at just £14.95, I wouldn't recommend it to the easily discouraged.

Contact: Quicksilva Limited, 13 Palmerston Park House, 13 Palmerston Road, Southampton, Hampshire, SO1 1LL.

"We're lost in music — caught in a trap — no turning back — we're lost in music" Sister Sledge 1984.

Music and machine code made easy

Sunshine Books has released two new books for 64 owners.

Beginning Machine Code On The Commodore 64 is a simple introduction to understanding and using the computer's own language. Authors David Lawrence and Mark England explain the origins of machine code, how binary arithmetic works, what each command means and how commands work together to form the language. Examples and do-it-yourself experiments give the programmer experience in using machine code.

Journalist and musician Mark Jenkins wrote Electronic Music On The Commodore 64, a book that discusses the 64's music capabilities and the wide range of music software and hardware available for it. The book explains the SID chip and elements of music theory and how the two combine to make music.

Both books cost £6.95.

Contact: Sunshine Books, 12/13 Little Newport Street, London WC2H 7PP. Tel: 01-437 4343.

Vital links

Downsway Electronics has released a new range of three interfaces for the VIC 20 and the 64.

The first links the 64 with any printers that have Centronics connections. The interface uses a ROM based cartridge that plugs into the expansion port, so it requires no additional software. Including printer lead and full instructions, it costs £29.95.

Two cassette interfaces, one for the VIC 20 and another for the 64, allow the loading of any program from any cassette player, including fast or turbo loaded programs. The units are complete with earphone, microphone and remote leads and plugs at a cost of £14.95.

Contact: Downsway Electronics Ltd, Depot Road, Epsom, Surrey KT17 4RJ. Tel: 03727-27222.

Not a dating service

A Milton Keynes company is offering a new information and delivery service for owners or potential owners of data communications equipment.

Datalines offers a range of datacomms products for sale including modems, interfaces and software for Commodore 3000, 400 and 8000 series machines and the 64. The company also serves as a technical advice and help service for those looking for new computer equipment or having problems with what they have.

Among Datalines' products are line drivers priced at £115 and £209, a modem at £754 and the Compatability Box, a serial interface converter, at £775.

Datalines also has its own viewdata set priced at £73.87, allowing the user to download the expanding range of leisure, educational, household and business software from Micronet 800. In addition, the modem gives access to Prestel, Homelink and electronic mail facilities.

Contact: Datalines, 68 Alson Drive, Bradwell Abbey, Milton Keynes MK13 9HB. Tel: 0908-311077.

Dialing up for help

Everything you want to know about home computers ... in three minutes.

Well not exactly, but British Telecom at Bradford has started a new Guideline Service "Home Computer Line". Callers dialing Bradford 722622 hear a three minute tape "giving all aspects of computer ownership," the company says.

A Hebden Bridge company, Information Unlimited, provides the messages, which are updated twice weekly but always aim for the home computer market. Contents initially will be about hardware, software and peripherals focusing on new products and ideas. Eventually it will include tips on programming and games.

Don't miss the boat!

Once more the computer has come to the rescue with a practical program to organise your life. Produced by Associated Services Ltd, Desk Diary for the C64 is a powerful program for keeping and editing appointments and engagements with the help of your computer.

A password protection system, menu driven routines and sharply defined screens let you manage your time with entries for any date up to 31 December 1992. In addition to recording engagements, you can list other information such as names and telephone numbers, tax details, etc. Entries can be called up one at a time or a page at a time. You can call up the dates of any calendar month from 1983 to 2057 or leave a message for another authorised Diary user.

Easy Script can also be used to record information for reading later on Desk Diary or prepare Desk Diary files to be read by Easy Script. Price of the package is £29.95 and includes disk and manual.

Digital Lab is a more technical product from ASL programmed to help design logic circuits using an array of parameters. The program acts as a logic laboratory, or a way of creating concrete logistical structures. A set of menus lists logic elements and logic links for your choice, and Digital Lab will check the validity of every gate and link in the circuit you create.

ASL says students as well as hobbyists can make use of Digital Lab, which includes an explanation of Boolean Algebra and its use in logic circuits. Written in C64 6502 Assembly language, the disk sells for £29.95 with a manual.

Contact: Associated Services Ltd, 23 Chesham Street, London SW1X 8NQ. Tel: 01-245 9522.

Dancing fingers

Step By Step Keyboarding On The Personal Computer is a new book specifically written for those poor devils out there still using the search-and-peck method.

Typing proficiency is a problem among many computer programmers. Steven Radlauer discusses how to increase typing and word processing speed while remaining efficient. All typing skills and special computer operations are taught one step at a time, then strengthened through practice exercises and drills.

Topics include word processing techniques, preparation of business correspondence and editing and proofreading. The book also focuses on numerous business applications and on major words and symbols of Basic.

Contact: Barron's, 33 Sackville Street, London W1X 1DB. Tel: 01-734 7282.

It's official

Prism Microproducts has introduced a viewdata system with official Micronet software to download programs and pages from the Micronet 800 database into the 64.

Users of the Prism system, which includes modem and software, can access Prestel, Micronet 800, Viewfax 258 and other public and private viewdata systems. Customers can actually download programs from Micronet in addition to the standard page-viewing functions. 64 users also can send and receive files and programs to and from other 64 users.

The package comes complete with the appropriate cables and software in cartridge form to be inserted into the expansion port. It retails at £129.95.

Contact: Prism Microproducts Ltd, 18/29 Mora Street, City Road, London EC1V 8BT. Tel: 01-253 2277.

(See Business Supplement this month for full review)

Personalised print shop

Greeting cards, stationary and letterheads with a personal touch are at your fingertips with a new package from US company, Broderbund Software.

Called The Print Shop, the program for the 64 enables the user to write, design and print the above items as well as signs and even banners, without a comprehensive knowledge of graphics. With one pass through your printer, The Print Shop will produce a greeting card with both inside and outside message, including a credit line on the back.

Automatic centring and left and right justification are among the text-editing features included in the package. It also produces a custom-designed letterhead with logo or full-page signs with graphics. A banner of unlimited length can be created by printing out the text and graphics horizontally.

The menu driven program includes eight typestyles in multiple sizes and in solid, outline and three-dimensional formats. Nine border designs, 10 abstract patterns and dozens of pictures and symbols add to the variety of designs available.

A built-in Graphics Editor lets you build on designs already provided, such as kaleidoscopic animations, or simply create your own symbols and pictures.

Complete with an illustrated manual, reference card and a colour assortment of pin-feed paper, The Print Shop costs $44.95 and is distributed in the UK by Ariolasoft. (UK price to be announced.)

Broderbund also are releasing The Music Shop, a music composing program, in the UK. Initially available for the 64, this package combines the functions of a music composer and a music synthesiser. The first helps the potential musician to create, store and edit compositions and print out sheet music. The synthesiser manipulates the 64's versatile SID chip to add a variety of textures to the melodies written.

Music Shop, which sells for $44.95, includes a Macintosh-like user interface with easy-to-use pull-down menus, windows and dialogue boxes which you control using keyboard or joystick. Musical notation is recorded on screen a page at a time and the program can automatically "turn" to the next page as the music plays, eliminating the often difficult-to-read scrolling movement. Each piece of music can be up to 20 pages in length.

Musician-turned-programmer Don Williams, who wrote Music Shop, also added word processing type editing commands and facilities to write and play back whole notes to 32nd notes, dotted notes, ties and triplets in eight time signatures.

Contact: Ariolasoft UK, Ashphelte House, Palace Street, London SW1. Tel: 01-834 8507; or Broderbund Software, 17 Paul Drive, San Rafael, CA 94903-2101. Tel: 415 479-1170.

New standard

Joreth Music has entered the computer music world with its new Music Composer System for the 64.

MCS combines an interface, the AL25 MIDI Link, and software for a package which is intended to "supply musicians of all abilities and from any background with a composing/recording tool which is both simple enough to operate in minutes, but powerful enough to cope with a vast range of musical tasks."

Among the perks is the ability to input and output to external drum machines or sequencers, enabling the player to synchronise to multi-track audio recording machines by using a suitable signal processor that often comes with drum machines and sequencers. The total MCS package sells for about £200. A combination of two MCS systems and two 64s provides the potential for 16 tracks.

Contact: Joreth Music, 43 Brewers Lane, Badsey, Evesham, Worcestershire WRU 5EU. Tel: 0386 831615.

Sophisticated machine code

Thirty ready-made machine code routines published in Supercharge Your Commodore 64 are claimed to "give the Commodore 64 all the power of machine language without the reader having to learn machine language."

Author Barry Thomas includes routines that perform a variety of tasks such as high-resolution, high-speed screens, enlarge sprite-definition memory, manipulate sprites and screen colours, move memory blocks and renumber Basic programs. Publisher Melbourne House says the book will help "develop programs of professional quality."

Recommended retail for Supercharge Your Commodore 64 is £6.95.

Contact: Melbourne House, Castle Yard House, Castle Yard, Richmond. Tel: 01 940 6064.

Hook up your own

A new cassette interface for the 64 and VIC 20 allows you to use a standard home cassette recorder with your machines.

Costing just £17.99, the PANDA 20/64 interface gives you the option of using the recorder for other purposes such as music and speech.

The 20/64 has a special phase switch that enables it to cope with different types of recorder and tape quality, and small green and red lamps indicate when a program is being saved to or loaded from cassette.

Pact International, maker of the 20/64, says the interface also works with fast loaders.

Contact: Pact International Ltd, PO Box 50, Peterborough. Tel: 0733 233600.

Clean up the floppy

Ross Electronics has announced a new line of home computer peripherals including two head cleaning systems for floppy disk drives.

The wet system head cleaner for 5¼ inch disk size cleans single and double-sided drives. THE RC-80 takes only 15 seconds to clean read/write heads and the kit contains enough solution for 15 treatments.

The RC-86 is a dry system cleaner which also loads like a floppy disk. The 20-second cleaning cycle removes oxide residue and dust and is suitable for both single and double-sided drives. Five spare disks allow 150 cleaning operations.

Both the RC-80 and RC-86 cost £11.95.

Contact: Ross Electronics, 49-52 Pancras Way, London NW1 2QB. Tel: 01-278 6371.

Notes on 64 music

The growing interest in computer music is showing itself in more than software and peripherals.

Sunshine Books has published Commodore 64 Music by Ian Waugh to explain the full workings of the machine's sound chip, SID, and how to take it to its full potential with programs written in Basic. Waugh, a professional musician, covers elements of music including programs to produce chorus, echo, polyphonic music, microtonal scales and sound effects such as seagulls and foghorns.

The book also explains how to make the 64 produce and play its own compositions. It retails at £6.95.

Contact: Sunshine Books, 12/13 Little Newport Street, London WC2R 3LD. Tel: 01-437 4343.

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We also Repair BBC's and Spectrum Computers. (The above prices are exclusive of vat & p&p.)

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Flight Path 737 -7.95, Kong £7.95, Skramble £7.95. All this is the game. Jorn Arild Erikson, Box 314, 9991 Batsfjord, Norge.

CBM 64 Software depth charge £2.90 Sooper Froot £2.90. Falcoln Patrol £3.50, Arcadia £3.50, Books — Machine code master £5.50, working CBM 64 £4.50 CBM 64 Program Book £4.00. All as new — phone Northwick 782475.

Gone 16 Bit Commodore 8096, 8050 disks silicon office, simply file, simple write. Whitby chip JCL business ROM Calco master. Recorder disk cleaning kit. Will split 0926-3831 evenings (Warwicks).

CBM 64 software to exchange disk only please. Phone (0602) 258482 or write including your list of programs to M Pepper, 11 Thornhill Close, Bramcote Hills, Beerton, Nottingham NG9 3FS.

Swap over £150 worth of original software in perfect condition, including Ultisynth and Ghostbusters for a Commodore 1520 printer/plotter in good condition. Phone Sheffield (0742) 480111.

SX64 owners — programs PCB and details on how to use a datasette with the SX-64. Full M/L program on disk. Contact W.T. Smith Box 11097 Dubai U.A.E. or phone 440790 before 8p.m. G.M.T.

CBM 64 owner wishes to exchange software on disk. Already over 1000 programs collected. Send lists to Jukka Kemppinen, Matomaentie 5 56800. Simpele Finland. All letters answered. Tel: 5472115.

C-64, I would like to exchange software of games, graphic sound and more on tape or disk. Letters are welcome. Ronen Shpiqel. PO Box 2638 Afula, Israel.

Vic 20 owner wishes to swap software to listings. Plenty of games and home-made listings. Perry parker, Muntham House Sch. Barns Green, Horsham, W. Sussex RH13 7NJ.

Wanted for CBM 64 Disc drive, printer, Simons Basic, easy File, Easy Script, and disc utilities. Tel: 0624-823653 or write to Ken Page "The Corniel" Bayr, Crianagh, Castletown, Isle of Man.

Dutch 64 owner wants software swapping with non-comm. CBM freaks. Please send disks with recent games to Thomas Tellings 4 Ebstroom 3224 CD Hellevoet-Sluis Holland. Reactions with disk prompt reply.

CBM 64 owner would like to swap software. More than 1200 programs available. Only disk. Write to: F Engelberts, Box 1422, 2970 Emden, West Germany.

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CBM 64 — Do you want to swap games, over 600 titles already. Send list to: Trond Nordbo, Stoltenbergvei 15, 7000 Stravanger Norway.

Finnish CBM 64 and PET 4032 user wishes to swap or buy progs. on disk. Write to Peter Abbott, PO Box 47, 02661 Espoo 66, Finland.

Software to swap — International Soccer, Flight Path, Motormania, Football Manager, Cricket, Falcon Patroll II etc. Require Zaxxon, Aztec Challenge, Ant Attack, Intro. to Basic, Deadline, Hobbitt, Twin Kingdom Valley. Tel: 01-427 8158 (eves).

Swap 48K Sinclair spectrum with £190 worth of software, joystick interface etc. for 1541 disk drive or MPS 801 printer. Please write to: B Miller 31 Greenway Road, Widnes, Cheshire WA8 6HE.

Swap CBM 64 software (Superbase, Easifile, Paperclip, Petspeed, Mikro, Simons, Hobbit, Dallas, Long List) for good camera or W.H.Y. write, Tudorsoft, 35 Broomfield Ave, Leigh-on-Sea. Essex or phoen 0702-529431.

CBM 64 software for sale: Cluedo (cassette) and Colossus Chess (disk) new at half price £6 each. Phone (0702) 520624.

Vic 20 starter pack + 4 cartridges + 14 tapes, Programmers ref. guide worth £235. Sell for £130. Tel: Ashford, Kent (0233) 27949 after 4.30p.m.

CBM 64 owner wishes to swap sell or buy quality software. Already a large collection of english and american games. Send lists to mark, 55 Princes Drive, Colwyn Bay, Clwyd, LL29 8PW.

Dutch CBM 64 owner wishes to exchange software. Send you list to L.J. Van den Brink, Drieseweg 25, 3881 HC Dutten, Holland.

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Simons' Basic users: Let's swap our own programs. I want to set up a library. Send tape and S.A.E. for details. Brian Taylor 8 Coniston Way, Woodlesford, Leeds LS26 8RR.

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Swiss connection C64: I buy or exchange business and educational (language) software. Please contact: Manfred Dechmann, Herrenbergstrasse 1 CH8006 Zurich, Switzerland.

Wanted business software on tape for expanded Vic 20. Details, prices please: Norman Fryatt 64 Salisbury Road, Manor Park, Newham, London E12 6AB.

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Swap my games for CBM 64. Send your list or letter to Uiver, Engelsestraat 28, U611 RR Bergen Op 200M, The Netherlands. Everyone will be answered soon.

Videopak 80 word processor cartridge. 80/40 columns plus keys mask. Ring 0234-223074. Day only — Ask for Maldwyn. £50 only.

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Back issues Commodore 80-84. Microcomputer Printout December 1979, First issue to December 84. Icpug se. May 1982 to July 1984. The PET index. Sell complete only ind binders. What offers. Phone Truman 01-286 9905.

Wanted: Programs on disk for my 64. I have many programs — games to trade. Please send disk with your list of wants to — Taff Hutchings, PO Box 48, Derby, DE6 6QP. All disks returned by first class mail.

CBM 64 and 1541 disk are looking for another CBM 64 and disk to exchange software. I've got 700 + titles. Users all over the world send you lists to: Olau Bruflat, Jutulveien 36, 1700 Sarpsborg, Norway.

Canadian junior Commodore 64 club would like to hear from other clubs. Please reply to Rob Burtch, 32 Kilbourne, St. Catherines, Ontario, Canada L2M 3E4.

Norwegian 64 owner wants to swap software — disk or cassette-based. Send your lists on disk, tape or paper to Tom Ulrichsennakkerud 3503, Tyristrand Norway. Tel: (067) 49349.

CBM 64 owner wants to swap software. Disk or cassette based. Send your list of programs to: Van Daele Peter, Wilgen Straat 2, 800 Brugge, Belgium. Tel: 0032-50-321586.

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C-64 games wanted Ariolasoft, Archon, Operation Whilwind or any strategic simulation games. Cassette only — Steve "Mossley" Orient Drive, Liverpool 25.

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micro magpie

DATABASE

Micro Magpie for the Commodore 64 is probably the most advanced database management system available for any home micro. With Micro Magpie you can create a database system tailored exactly to your own information handling requirements.

With most database systems, you only get out what you put in. Micro Magpie gives you more! It can manipulate data between different files, perform calculations on numerical data, print out reports, and hardcopy data in graphical form. Only Micro Magpie can give you all these features . . .

- Fully user programmable database management system.
- Operated by easy-to-use pop-up menus using just four keys.
- 100% machine code program for speed and compactness.
- Can perform complex calculations on numerical data.
- Searches on any field, with wild card and part-field matching.
- Works with one or two 1541 disk drives.
- Horizontal or vertical bar graph or scatter graph output.
- Integral Centronics interface for parallel printer option.
- Professionally written instruction manual.
- Help readily available from Help Disk.
- Free application templates - Mailing List and - Stock Control.

Micro Magpie would be excellent value if you bought it for the applications alone! You can have a highly sophisticated Mailing List system up and running within minutes, and you'll still be using only a fraction of Micro Magpie's potential! Once you start tailoring your own custom applications, you will begin to discover why Commodore User magazine called Micro Magpie "the software bargain of the year"!

MICRO MAGPIE - ON DISK ONLY

£39.95 inc VAT

Micro Swift

SPREADSHEET

Micro Swift - the affordable professional spreadsheet system for the Commodore 64. Micro Swift will prove indispensable in business or around the home to construct models of income and expenditure; for carrying out instant 'what-if' calculations to see how a change in one or more figures affects all the other figures; or for specialised applications where complex number crunching is required.

Micro Swift is unique in that it is operated by pop-up menus, a system pioneered by our Magpie database program. No longer do you have to memorise a whole hierarchy of commands and control keys - the menus appear when you want them, and disappear when you don't.

Micro Swift is written totally in machine code (beware other spreadsheets in Basic!) for speed and compactness, giving you more room to construct more complex models.

Micro Swift gives you these amazing features . . .

- A1 to Z254 cell matrix.
- Variable cell widths.
- Split screen facility.
- User definable numerical precision and display formatting.
- Integral Centronics Interface for parallel printer option.
- Automatic execution of user-programmed sequences.
- Graphical display option.
- Operated by easy-to-use pop-up menus.
- Free ready-programmed applications included.
- File storage on disk or cassette.
- Full instruction manual included.

Don't be fooled by the price! Micro Swift gives you facilities equal, if not superior, to spreadsheets costing many times more. Micro Swift is available on disk or cassette. Micro Swift - Spreadsheet power to the people!

MICRO SWIFT - ON DISK OR CASSETTE

£19.95 inc VAT

MICRO WORDCRAFT

WORD PROCESSOR

Micro Wordcraft is our new disk-based professional word processor. It is a direct descendant of the highly respected Wordcraft program, which is in use world-wide on the larger Commodore machines, Sirius, and IBM PC, etc. Written in 100% machine code, Micro Wordcraft spells affordable office quality word processing for the home or business user.

It is often said that "you get what you pay for"; but with the Audiogenic Professional Series you get what you pay for and more!

Micro Wordcraft gives you all these advanced facilities . . .

- Full text control - document width up to 99 columns, tabs, decimal tabs, justification and centering.
- Full text manipulation - on-screen editing, block move, block delete, string search and replace, underlining and emboldening.
- Scrolling screen display, uncluttered by control characters.
- Name and address files can be created and merged into standard letters.
- Easy merging of standard paragraphs. Compatible with Commodore, parallel and RS232 printers.
- Integral Centronics interface for parallel printer option. Instantly accessible Help screens.
- Comprehensive instruction manual included.

The name and address merging capabilities of Micro Wordcraft make it an ideal tool for small businesses, clubs, societies or hobby groups, where there are regular mailings of standard letters. For home use, Micro Wordcraft contains all the facilities you could ever need, at a price you can easily afford!

MICRO WORDCRAFT - ON DISK ONLY

£24.95 inc VAT

The Audiogenic Professional Series represents a price breakthrough for business-orientated software products. With Micro Magpie, Micro Swift, and Micro Wordcraft, the power and convenience of the computerised office can be a reality for all Commodore 64 owners!

Each of the three products represents the state of the art in its particular field. Great care has been taken over the documentation to make sure that you, the user, can quickly make use of the facilities available. Also, a full backup service is provided by the Audiogenic Technical Department, who are only a phone call away if you have any queries about the products.

So, whether it's for your home, business, club or society, make sure you go for the Audiogenic Professional Series!

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PROFESSIONAL SERIES

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